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February 6, 1985

OGTP-810-0-506

Mr. L. C. Oakes
Washington Public Power Supply System
3000 George Washington Way
P. O. Box 460
Richland, WA 99352

Re: TDI Diesel Generator Owners Group
Revision 1 of Final DR/QR Report
for the Transamerica Delaval Diesel
Generators at WPPSS Nuclear Project 1
File: MTS-4086

Dear Mr. Oakes:

This letter forwards twenty-five (25) copies of Revision 1 of the final DR/QR Report for the TDI Diesel Generators installed at Washington Public Power Supply System Nuclear Project 1. This revision has been prepared and approved by the TDI Diesel Generator Owners Group Technical Staff.

Very truly yours,

C. L. Ray, Jr.

C. L. Ray, Jr.
Technical Program Director
TDI Diesel Generator Owners Group

CLR/TDM/cr

Attachments

cc w/attachments: Failure Analysis Associates (1)
Impell Corporation (1)
Stone & Webster Engineering Corp. (1)
Owners Group Executive Contacts

TDI DIESEL GENERATOR

DESIGN REVIEW AND QUALITY REVALIDATION REPORT

Prepared For

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

WPPSS NUCLEAR PROJECT 1

By

TDI DIESEL GENERATOR OWNERS GROUP

VOLUME 1

TDI DIESEL GENERATOR

DESIGN REVIEW

AND

QUALITY REVALIDATION

REPORT

prepared for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
WASHINGTON PUBLIC POWER SUPPLY SYSTEM - NUCLEAR PROJECT 1

by

TDI DIESEL GENERATOR OWNERS GROUP

Revision 1

February, 1985

Reviewed by: R J Deese

R.J. Deese Licensing Coordinator
TDI Diesel Generator Owners Group

Approved by: C.L. Ray Jr.

C.L. Ray Technical Program Director
TDI Diesel Generator Owners Group

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EXECUTIVE SUMMARY

Thirteen U.S. nuclear utilities have formed the Transamerica Delaval, Inc (TDI) Diesel Generator Owners Group in order to address operational and regulatory issues relative to Transamerica Delaval diesel generator sets used for backup power supplies in U.S. nuclear power plants. The TDI Diesel Generator Owners Group established a comprehensive program, through a combination of design reviews, quality revalidations, engine tests and component inspections, to provide an in-depth assessment of the adequacy of the respective utilities' TDI diesel generators to perform their intended safety related functions.

The first major program element was characterized as Phase I and involved the resolution of generic known problems. A review of the accumulated operational experience resulted in the conclusion by the Owners Group Technical Staff that a limited number of components warranted priority attention and consideration as significant known problems with potentially generic applicability. Final reports for each of these components were submitted by the Owners Group to the NRC for review. The purpose of this accelerated review was to establish a basis for licensing plants with TDI diesel generators prior to completion of the follow up effort described below. This review has shown that with implementation of the Phase I report recommendations, TDI diesel generators can reliably perform their intended function.

The second major program element involved design reviews and quality revalidations of selected engine components. The Owners Group Design Review and Quality Revalidation Program (DR/QR) was established to perform these examinations for each owner's engine in order to assess each engine's ability to reliably perform its intended design function. The effort was conducted by a centralized team of engineering personnel with specialized skills in appropriate fields including diesel generator design, operation, and manufacture.

The first portion of the DR/QR Program involved reviewing the Engine Parts List and selecting the components of each engine that warranted a detailed design review and/or quality revalidation. Following component selection these components were subjected to either a design review, a quality revalidation, or both. Upon completion of these reviews, the inspection results, document packages, design review findings and calculation results were reviewed and approved by the Owners Group Technical Staff.

The third major program element involved specific component tests and inspections. The Owners Group Technical Staff, in evaluating specific engine components, provided technical recommendations to each Owner regarding special component inspections, preventive maintenance, and surveillance recommendations which will give added assurance that the engines and components perform their intended operational functions over the life of the plant. The implementation of these recommendations is a plant-specific function.

This final report for Washington Public Power Supply System (WPPSS) provides the results of this extensive investigation of 174 components of the TDI DSRV-16 diesel generators at Washington Public Power Supply System - Nuclear Project 1. It forms the basis for the conclusion that the TDI diesel generators presently installed are fully capable of reliably performing their intended safety function.

1.0 INTRODUCTION

This report has been prepared for Washington Public Power Supply System by the TDI Diesel Generator Owners Group. The results of the Design Review and Quality Revalidation Program are specifically applicable to WPPSS - Nuclear Project 1 and are based on the generic program methodology briefly discussed in Section 2.0.

The purpose of this report is to provide the results of an extensive investigation of the design and manufacture of 174 components of the TDI DSRV-16 diesel generators at WPPSS - Nuclear Project 1. This report forms the basis for the conclusion that the TDI diesel generators presently installed are fully capable of performing their safety function as described in the WPPSS - Nuclear Project 1 Final Safety Analysis Report.

2.0 PROGRAM PLAN OVERVIEW

The TDI Owners Group Program Plan (the Plan) has been previously provided by reference (1). This overview of the Plan is provided to assist the reader in understanding the generic methodology by which the plant-specific results of Section 3.0 were obtained.

The Plan consists of two phases comprised of the following major elements:

Phase I
Generic Problem Resolution

Phase II
Component Selection
Task Description Preparation
Design Review
Quality Revalidation
Final Documentation

Each element is briefly discussed in the following sections.

2.1 GENERIC PROBLEM RESOLUTION - PHASE I

Using input from various nuclear data sources (INPO, SOERs, LERs, 10CFR50.55e reports & 10CFR21 reports, etc) as well as non-nuclear sources (marine and stationary TDI engine applications), a substantial data base of TDI engine/component operational experience has been accumulated.

A review of this data by the TDI Diesel Generator Owners Group Technical Staff resulted in the conclusion that a limited number of TDI engine components had evidenced sufficient adverse operating experience in one or more applications, such that they warranted priority attention and consideration as significant known problems with potentially generic applicability. Therefore, the Owners Group technical resources were heavily applied to these problem areas in order to expedite the reviews, tests and/or analyses necessary to resolve them. The purpose of this accelerated review was to establish a basis for licensing those plants with near term licensing needs prior to the completion of the Phase II effort.

Resolution of these problems has been pursued on a priority basis and was termed the Phase I effort. The generic known problem listing is generic only to the extent that a body of experience exists to suggest that a design type (or several design types) of a particular component in service in one or more TDI engine applications has not performed acceptably or may not have been designed adequately.

A listing of the identified generic components is included as Table 2.1. Reports on these components have been previously submitted to the NRC for review. Summary Phase II reports for the generic problems (Phase I components) as they apply to WPPSS - Nuclear Project 1 are included in Appendix I of this report.

The results of the reviews of these components are summarized in Section 3.0.

2.2 COMPONENT SELECTION

The diesel generator components to be subjected to the DR/QR Program were determined by a Component Selection Committee. Selection was based on the component's function and role in the overall operation of the engine, the component's nuclear and non-nuclear industry experience, and the Committee's engineering judgement. The selection process included a review of available operating information on TDI diesels and TDI recommended product improvements to ensure that relevant experience was considered.

As part of the component selection process, components were classified as either type A, B, or C. These classifications are based on the effect of the component's failure on the diesel generator performance. Type A components are those whose failure would result in diesel generator shutdown or failure to start in an accident mode. Type B components include those whose failure would result in reduced capacity of the diesel generator or the eventual failure of a Type A component if not detected. Components whose failure have little or no bearing on the effective use or operation of the diesel generator are classified as Type C.

Following classification, the Committee established appropriate design review and quality revalidation requirements. These requirements were then forwarded to the Design Review Group and Quality Revalidation Group for preparation of task descriptions.

Table 2.2 lists those components of the WPPSS - Nuclear Project 1 diesel generators which were reviewed by the Component Selection Committee. The Table identifies the results of the Component Selection process by showing which components required a design review (DR) and/or a quality revalidation (QR), and those components requiring no review. The Category identified in Table 2.2 refers to the Appendix I heading under which that component's DR/QR Summary Report is found.

2.3 TASK DESCRIPTION PREPARATION

The Design Review Group and the Quality Revalidation Group prepared task descriptions to define the tasks (reviews, inspections, calculations, etc.) to be performed to determine the adequacy of each component. The task descriptions included recommendations identified in the selection process as well as Design Review Group and/or Quality Revalidation Group recommended component inspections. These task descriptions provide, as applicable:

A. DR Task Descriptions
   1. Primary component function and required attributes,
   2. Applicable codes and standards,
   3. Alternative codes, standards, or analytical techniques,
   4. Analysis or evaluation to be performed to assure satisfactory design,
   5. Available verifications of TDI analysis (if any), and
   6. Final documentation requirements.

B. QR Task Descriptions (Component Revalidation Checklist)
   1. Component to be validated
   2. Attributes to be verified
   3. Methodology to be used (documentation review, NDE techniques, etc.)
   4. Acceptance criteria
   5. Final documentation requirements

In some cases the Design Review Group and the Quality Revalidation Group prepared task descriptions which required no additional Design Review or Quality Revalidation for certain components. The individual task descriptions in Appendix I contain the justification for this reduction in scope. In general, the basis for not requiring a Design Review and/or Quality Revalidation Report is the following:

> Lead Engine Component Reviews - This component was reviewed on a lead engine. Any recommendations which supported the conclusions in the lead engine report are evaluated for applicability to the follow on engine component and included in the task description.
>
> Experience - Either no adverse site or industry experience exists or if it does exist, the task description addresses its resolution.

Task descriptions for all components are included with each component's DR/QR Summary Report in Appendix I. Figure 2.1 graphically depicts the process followed in the DR/QR Program.

2.4 DESIGN REVIEW

The Design Review Group completed the design review in accordance with the task descriptions. Due to the number and diversity of the components and standards involved, the design review was tailored to each component. The actual design review was accomplished by using any one or more of the following methods, including: a) an independent calculation performed by the Design Review Group; b) an independent review of the adequacy, appropriateness or correctness of existing vendor and/or subvendor calculations; c) testing specified by the Design Review Group; or, d) other methods specified and approved in the task descriptions.

During implementation of the task descriptions, the Design Review Group specified quality attributes (in addition to those identified during the component selection process) for incorporation into the quality revalidation process. The Design Review Group also identified any components which may require corrective action to improve reliability of the diesel generators. This included recommendations such as increased frequency of component replacement and/or maintenance, or additional in-service inspection.

2.5 QUALITY REVALIDATION

The Component Quality Revalidation Group was provided with the quality attributes required to be revalidated. QR Task Descriptions were developed to identify methodology for verification of attributes. These task descriptions include applicable component descriptions, attributes to be verified, methodology, acceptance criteria, and type of documentation to be provided.

Each component required to undergo Quality Revalidation was subjected to a documentation review. This process identified and catalogued all appropriate documentation (e.g. material test reports, NDE, vendor/subvendor records, site records, etc) associated with the component. With assistance from Quality Engineering, each document was reviewed for acceptability. These document packages were then made available to the Design Review Group to assist in the engineering review. Important attributes identified by the Design Review Group, for which acceptable documentation did not exist in the component file, were verified by tests and/or inspections performed by the Quality Group.

Tests or inspections required to be performed on components were then forwarded to Quality Engineering to develop detailed methodology and procedures to be followed. These instructions were issued to Quality Inspection via the task description. Field inspections and tests were performed by qualified personnel. Depending upon the specified test or inspection, spare parts or surplus parts in lieu of installed parts were used as the test/inspection article. Results of inspections and tests were summarized by the Quality Revalidation Group and reviewed by the Design Review Group as necessary.

2.6 FINAL DOCUMENTATION

The DR/QR program has been completed for Washington Public Power Supply System. A summary of the results of this effort are contained in Section 3.0.

Appendix I contains component DR/QR Summary Reports which provide a detailed summary of the review and analysis performed on each component including references to supporting documentation and the recommendations and conclusions resulting from this effort.

Appendix II contains a comprehensive set of maintenance and surveillance recommendations for each component. These recommendations were derived from existing vendor recommendations and the individual component DR/QR Summary reports. The purpose of this Appendix is to provide the utility a basis for its maintenance and surveillance program which will maintain the qualification of its diesel generators for the life of the plant.

This entire report constitutes final documentation of the completion of the DR/QR Program on the WPPSS - Nuclear Project 1 TDI diesel generators.

TABLE 2-1

PHASE I COMPONENTS (GENERIC PHASE I)

COMPONENT NUMBER	COMPONENT
MP-017	Turbocharger
03-305A,C,D,E	Base & Bearing Caps
03-310A	Crankshaft
03-315A&C	Cylinder Block & Liners
03-315E	Cylinder Head Studs
03-340A	Cylinder Rods
03-340B	Connecting Rod Bearing Shells
03-341A	Pistons
03-359	Airstart Valve Capscrews
03-360A	Cylinder Heads
03-365C	Fuel Oil Injection Tubing
03-390C&D	Main and Connecting Pushrods
03-390G	Rocker Arm Capscrews
03-425A	Jacket Water Pump
03-688B	Wiring & Termination

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
F-068	Intercooler	X	X		Turbo, Intake Intrclr. & Exhaust
F-139	Tools Turbo			X	
F-161	Pyrometer Wire			X	
MP022/23	Turbocharger	X	X		Turbo, Intake, Intrclr. & Exhaust
SE-025	Lube Oil Full Pressure Strainer	X	X		Lube Oil
00-420	Lube Oil Pressure Regulating Valve	X	X		Lube Oil
00-442A	Starting Air Distributor: Distributor Assembly	X	X		Air Start & Barring Device
00-442B	Starting Air Distributor: Tubing, Fittings, Gaskets	X	X		Air Start & Barring Device
00-491A	Turbocharger - Air Inlet Adapter: Adapter			X	
00-491B	Turbocharger - Air Inlet Adapter: Mounting Hardware W/Flexible Connector			X	
00-495A	Turbocharger - Air Outlet Adapter			X	
00-495B	Turbocharger Air Outlet Adapter: Mounting Hardware			X	
00-520	Instruction Plate - Warning Plate			X	
00-621A	Fuel Oil Drip Tank Assembly	X	X		Fuel Oil Injection
00-621B	Fuel Oil Drip Tank Assembly-Misc. Hardware, Gasket, Switch			X	

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-CFR	Turbocharger Thrust Bearing Lubrication System	X	X		Turbo, Intake, Intrclr. & Exhaust
02-305A	Base and Bearing Caps: Base Assembly	X	X		Engine Base & Bearing Caps
02-305B	Base and Bearing Caps: Dowels			X	
02-305C	Base and Bearing Caps: Main Bearing Studs & Nuts	X	X		Engine Base & Bearing Caps
02-305D	Base and Bearing Caps: Main Bearing Caps	X	X		Engine Base & Bearing Caps
02-305E	Base and Bearing Caps: Seals, Gaskets & Covers			X	
02-307A	Lube Oil Fittings: Internal - Headers	X	X		Lube Oil
02-307B	Lube Oil Fittings: Internal - Tubing & Fittings	X	X		Lube Oil
02-307C	Lube Oil Fittings Internal: Seals			X	
02-307D	Lube Oil Fittings Internal: Supports	X	X		Lube Oil
02-310A	Crankshaft	X	X		Crankshaft & Bearings
02-310B	Main Bearings	X	X		Crankshaft & Bearing
02-310C	Crankshaft & Bearings: Thrust Bearing Rings.	X	X		Crankshaft & Bearing
02-311A	Crankcase: Crankcase Assy	X	X		Crankshaft & Bearing

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-311B	Cylinder Block Liners & Water Manifold: Cam Bearing Caps & Dowels			X	
02-311C	Crankcase: Crankcase Seal			X	
02-311D	Crankcase: Crankcase Mounting Hardware	X	X		Crankshaft & Bearings
02-315A	Cylinder Block	X	X		Cyl. Block & Liners & Water Manifold
02-315B	Cylinder Block: Block To Crankcase Dowel			X	
02-315C	Cylinder Block Liners & Water Manifold - Cylinder Liner	X	X		Cyl. Block & Liners & Water Manifold
02-315D	Jacket Water Manifold Piping	X	X		Cyl. Block & Liners & Water Manifold
02-315E	Cylinder Block Liners & Water Manifold: Studs	X	X		Cyl. Block & Liners & Water Manifold
02-315F	Cylinder Block Liners & Water Manifold: Cylinder Head Nuts	X	X		Cyl. Block & Liner & Water Manifold
02-315G	Cylinder Block Liners & Water Manifold: Seals & Gaskets	X	X		Cyl. Block & Liners & Water Manifold
02-316A	Jacket Water Inlet Manifold: Manifold Assembly W/Hardware and Coupling and Gaskets	X	X		Jacket Water
02-316B	Jacket Water Inlet Manifold: Coupling and Gaskets	X	X		Jacket Water

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-316C	Jacket Water Inlet Manifold: Vent line to Discharge Manifold	X	X		Jacket Water
02-317A	Water Discharge Manifold: Manifold Piping	X	X		Jacket Water
02-317B	Water Discharge Manifold: Coupling & Seals	X	X		Jacket Water
02-317C	Water Discharge Manifold: Supports	X	X		Jacket Water
02-330A	Flywheel	X			Flywheel
02-330B	Flywheel Bolting	X	X		Flywheel
02-331	Guards: Flywheel Guard Assembly			X	
02-335A	Front Gear Case: Gear Case			X	
02-335B	Front Gearcase Bolting	X	X		Idler Gear Assembly & Front Gear Case
02-340A	Connecting Rods: Rods & Bushings	X	X		Connecting Rods
02-340B	Connecting Rod Bearing Shells	X	X		Connecting Rods
02-341A	Pistons	X	X		Pistons
02-341B	Pistons: Rings	X	X		Pistons
02-341C	Piston Pin Assembly	X	X		Pistons
02-345A	Tappets and Guides: Intake & Exhaust Tappet Assembly	X	X		Camshaft & Valve Train

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-345B	Tappets and Guides: Fuel Tappet Assembly	X	X		Camshaft & Valve Train
02-345C	Tappets and Guides: Fuel Pump Base Assembly	X	X		Camshaft & Valve Train
02-350A	Camshaft: Camshaft Assembly	X	X		Camshaft & Valve Train
02-350B	Camshaft: Camshaft Bearing	X			Camshaft & Valve Train
02-350C	Camshaft: Supports, Bolting and Gear	X	X		Camshaft & Valve Train
02-355A	Idler Gear Assembly: Crank To Pump Gear	X	X		Idler Gear Assembly & Front Gear Case
02-355B	Idler Gear Assembly: Idler Gear Assembly	X	X		Idler Gear Assembly & Front Gear Case
02-355C	Idler Gear Assembly: Gaskets & Bolting			X	
02-359	Air Start Valve	X	X		Air Start & Barring Device
02-360A	Cylinder Heads	X	X		Cylinder Heads & Valves
02-360B	Cylinder Head Valves: Intake & Exhaust Valves	X	X		Cylinder Heads & Valves
02-360C	Cylinder Head and Valves: Bolting and Gaskets	X	X		Cylinder Heads & Valves
02-360D	Cylinder Head & Valves: Springs and Retainers	X	X		Cylinder Heads & Valves
02-361	Indicating Cocks			X	

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-362A	Cylinder Head Covers: Subcover Assembly	X	X		Camshaft & Valve Train
02-362B	Cylinder Head Covers: Gaskets and Bolting			X	
02-365A	Fuel Injection Equipment: Fuel Injection Pump	X			Fuel Oil Injection
02-365B	Fuel Injection Equipment - Fuel Injection Tips	X			Fuel Oil Injection
02-365C	Fuel Injection Equipment - Tube Assembly	X	X		Fuel Oil Injection
02-365D	Fuel Injection Equipment: Supports	X	X		Fuel Oil Injection
02-371A	Fuel Pump Linkage: Fuel Pump Control Shaft	X	X		Fuel Oil Injection
02-371B	Fuel Pump Linkage: Linkage Assembly and Bearing	X	X		Fuel Oil Injection
02-373A	Gear Case Opening - Cover			X	
02-373B	Gear Case Opening Cover - Gaskets & Bolting			X	
02-375	Intake Manifold and Piping	X	X		Turbo, Intake, Intrclr. & Exhaust
02-380A	Exhaust Manifold	X	X		Turbo, Intake, Intrclr. & Exhaust
02-380B	Exhaust Manifold: Gasket and Bolting	X	X		Turbo, Intake, Intrclr. & Exhaust
02-385A	Cylinder Block Covers: Covers and Relief Valves			X	

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-385B	Cylinder Block Covers: Gaskets and Bolting	X	X		Cyl. Block & Liners & Water Manifold
02-386A	Crankcase: Crankcase Cover Assy			X	
02-386B	Crankcase: Crankcase Gaskets and Mounting Hardware	X	X		Crankshaft & Bearings
02-387A	Crankcase Ventilator: Crankcase Vacuum Fan			X	
02-387B	Crankcase Ventilator - Oil Separator			X	
02-390A	Intake & Intermediate and Exhaust Rocker Shaft Assembly	X	X		Camshaft & Valve Train
02-390B	Rocker Arms and Pushrods: Exhaust Rocker Shaft Assembly	X	X		Camshaft & Valve Train
02-390C	Main and Connector Pushrods	X	X		Camshaft & Valve Train
02-390D	Rocker Arms and Pushrods: Pushrods Connector.	X	X		Camshaft & Valve Train
02-390E	Rocker Arms and Pushrods: Bushings	X			Camshaft & Valve Train
02-390F	Rocker Arms and Pushrods: Lifters	X	X		Camshaft & Valve Train
02-390G	Rocker Arms and Pushrods Misc. Bolts & Drive Studs	X	X		Camshaft & Valve Train
02-395A	Gear Case Covers: Cover			X	
02-395B	Gear Case Covers: Gaskets and Bolting			X	

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-410A	Overspeed Trip Governor	X	X		Overspeed Trip & Governor
02-410B	Overspeed Trip: Governor and Accessory Drive Assembly	X	X		Overspeed Trip & Governor
02-410C	Overspeed Trip: Couplings (Flexible and Spider)	X	X		Overspeed Trip & Governor
02-410D	Overspeed Trip Vent Valve	X	X		Overspeed Trip & Governor
02-411A	Governor Drive: Governor & Tachometer Drive Gear and Shaft	X	X		Overspeed Trip & Governor
02-411B	Governor Drive: Couplings, Pins & Keys	X	X		Overspeed Trip & Governor
02-413A	Governor Linkage and Cross Shaft Assembly	X	X		Overspeed Trip & Governor
02-413B	Fuel Pump Linkage: Automatic Shutdown Cylinder	X			Fuel Oil Injection
02-415A	Governor Assembly: Woodward Governor	X	X		Overspeed Trip & Governor
02-415B	Governor Assembly - Booster Servomotor	X			Overspeed Trip & Governor
02-415C	Governor Assembly - Heat Exchangers	X	X		Overspeed Trip & Governor
02-420	Engine Driven Lube Oil Pump	X	X		Lube Oil
02-425A	Engine Driven Jacket Water Pump	X	X		Jacket Water
02-425B	Jacket Water Pump: Cover Plate			X	

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-435A	Jacket Water Fittings: Pipe & Fittings	X	X		Jacket Water
02-435B	Jacket Water Fittings - Supports	X	X		Jacket Water
02-435C	Jacket Water Inlet Fittings - Valves	X	X		Jacket Water
02-436A	Intercooler Piping - Pipe	X	X		Turbo, Intake Intercooler & Exhaust
02-436B	Intercooler Piping Coupling, Gaskets, Bolting	X	X		Turbo, Intake Intercooler & Exhaust
02-437	Turbo Water Piping: Pipe & Fittings	X	X		Jacket Water
02-441A	Starting Air Manifold: Piping, Tubing and Fitting	X	X		Air Start & Barring Device
02-441B	Starting Air Manifold Valves, Filters & Strainer	X	X		Air Start & Barring Device
02-441C	Starting Air Manifold: Supports	X	X		Air Start & Barring Device
02-445	Fuel Oil Booster Pump	X	X		Fuel Oil Injection
02-450A	Fuel Oil Header: Piping/Tubing	X	X		Fuel Oil Injection
02-450B	Fuel Oil Header: Fuel Oil Supports	X	X		Fuel Oil Injection
02-455A	Fuel Oil Filters & Strainers: Filters	X			Fuel Oil Injection
02-455B	Fuel Oil Filters & Strainers: Strainers	X			Fuel Oil Injection

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-455C	Fuel Oil Filters & Strainer: Mounting Hardware	X	X		Fuel Oil Injection
02-465A	Lube Oil Lines External: Tubing, Fittings, Couplings	X	X		Lube Oil
02-465B	Lube Oil Lines External Supports	X	X		Lube Oil
02-465C	Lube Oil Lines External-Valves	X	X		Lube Oil
02-467A	Turbocharger: Lube Oil Fitting - Piping	X	X		Lube Oil
02-467B	Turbocharger: Lube Oil Fittings - Supports	X	X		Lube Oil
02-475A	Turbocharger: Bracket	X	X		Turbo, Intake, Intrclr. & Exhaust
02-475B	Turbocharger Bracket: Air Butterfly Valve Assembly	X	X		Turbo, Intake, Intrclr. & Exhaust
02-475C	Turbocharger: Bracket - Bolting & Gaskets	X	X		Turbo, Intake, Intrclr. & Exhaust
02-500A	Control Panel Assembly Cabinet/System	X	X		Control Panel Assembly
02-500B	Control Panel Assembly: Annunciators			X	
02-500C	Control Panel Assembly: Circuit Breaker/Contact Blocks			X	
02-500D	Control Panel Assembly: Pressure Gauges			X	

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-500E	Control Panel Assembly: Hourmeter			X	
02-500F	Control Panel Assembly Accumulator	X	X		Control Panel Assembly
02-500G	Control Panel Valves	X	X		Control Panel Assembly
02-500H	Control Panel Assembly Pressure Switch	X	X		Control Panel Assembly
02-500I	Control Panel Assembly: Pyrometers			X	
02-500J	Control Panel Assembly: Control Relays	X	X		Control Panel Assembly
02-500K	Control Panel Assembly: Solenoid Valves	X	X		Control Panel Assembly
02-500L	Control Panel Components - Tachometer			X	
02-500M	Control Panel Assembly: Piping, Tubing, Fittings		X		Control Panel Assembly
02-500N	Control Panel Assembly: Terminal Boards/ Switches/Wiring		X		Control Panel Assembly
02-520	Instruction Plate: Nameplate			X	
02-525A	Barring Device - Pneumatic: Barring Device Assembly			X	
02-525B	Barring Device - Pneumatic: Regulator Valve/Shutoff Valve	X	X		Air Start & Barring Device
02-525C	Barring Device - Pneumatic: Misc. Fitting, Hose, Filters Tubing			X	

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-525D	Barring Device - Pneumatic: Mounting Bracket/Supports		X		Air Start & Barring Device
02-530A	Platform - Front & Side: Side Platform Assembly			X	
02-530B	Platform - Front & Side: Front Platform Assembly			X	
02-530C	Platform - Front & Side: Platform Bracing			X	
02-531A	Platform Ladder Front - Platform Assembly			X	
02-531B	Platform Ladder Front - Bracing			X	
02-540A	Lube Oil Sump with Strainer Assembly and Mounting Hardware		X		Lube Oil
02-540B	Lube Oil Sump Tank: Misc. Fittings, Gaskets, Pipe & Bolting Material, Valves	X	X		Lube Oil
02-540C	Lube Oil Sump Tank: Mounting Hardware	X	X		Lube Oil
02-550	Foundation Bolts: Anchor Bolts, Misc. Hardware	X	X		Engine & Aux. Sub Base & Foundation Bolts
02-590	Special Tools: Asst. Engine Assembly Tools			X	
02-630A	Pyrometer Conduit Assembly: Conduit	X	X		Engine Instrumentation & Wiring
02-630B	Pyrometer Conduit Assembly: Conduit Fittings	X	X		Engine Instrumentation & Wiring

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-630C	Pyrometer Conduit Assembly: Support	X	X		Engine Instrumentation & Wiring
02-630D	Pyrometer Conduit Assembly: Thermocouples	X			Engine Instumentation & Wiring
02-630E	Pyrometer Conduit Assembly: Gaskets			X	
02-688A	Engine & Aux Module Wiring Material- Conduit & Fittings; Pyrometer Assembly - Conduit, Fitting, Supports	X	X		Engine Instrumentation & Wiring
02-688B	Engine & Aux. Module Wiring Material: Wiring & Terminations	X	X		Engine Instrumentation & Wiring
02-688C	Engine & Aux. Module Wiring Material: Boxes & Terminals		X		Engine Instumentation & Wiring
02-689	Off-Engine Alarm Sensor Wiring	X	X		Engine Instrumentation & Wiring
02-690	On-Engine Alarm Sensors	X	X		Engine Instrumentation & Wiring
02-691	Off Engine Alarm Sensors	X	X		Engine Instrumentation & Wiring
02-695A	Engine Shutdown Equipment: Tubing/Fittings & Supports	X	X		Engine Shutdown & Equipment
02-695B	Engine Shutdown Equipment: Valves, Regulator, Orifices	X	X		Engine Shutdown & Equipment

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-695C	Engine Shutdown Trip Switches	X	X		Engine Shutdown & Equipment
02-700A	Jacket Water Standpipe: Pipe, Fittings, Gaskets	X	X		Jacket Water
02-700B	Jacket Water Standpipe: Supports	X	X		Jacket Water
02-700C	Jacket Water Standpipe: Pipe Supports			X	
02-700D	Jacket Water Standpipe: Switches	X	X		Jacket Water
02-700E	Jacket Water Standpipe & Misc. Bolting	X	X		Jacket Water
02-700F	Jacket Water Standpipe & Misc. Bolting	X	X		Jacket Water
02-717A	Auxiliary Skid	X	X		Jacket Water
02-717B	Aux Sub Base & Oil & Water Piping - Jacket Water: Valves	X	X		Jacket Water
02-717C	Aux Sub Base & Oil & Water Water Piping - Jacket Water: Pipe, Couplings, Fittings, Orifices and Strainers	X	X		Engine & Aux. Sub Base & Foundation Bolts
02-717D	Aux Sub Base & Oil & Water Piping - Jacket Water: Gaskets & Bolting		X		Jacket Water
02-717E	Aux Sub Base & Oil & Water Piping - Jacket Water: Supports	X	X		Jacket Water
02-717F	Aux. Sub Base & Oil & Water Piping - Lube Oil: Pipe and Fittings	X	X		Lube Oil

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-717G	Aux Sub Base & Oil & Water Piping - Lube Oil: Valves	X	X		Lube Oil
02-717H	Aux. Sub-Base & Oil & Water Piping - Lube Oil: Gaskets & Bolting	X	X		Lube Oil
02-717I	Aux Sub Base & Oil & Water Piping - Lube Oil: Supports & Mounting Hardware	X	X		Lube Oil
02-717J	Aux Sub Base & Oil & Water Piping - Fuel Oil - Piping & Fittings	X	X		Fuel Oil
02-717K	Aux Sub Base & Oil & Water Piping - Fuel Oil Valves	X	X		Fuel Oil Injection
02-717L	Aux Sub Base & Oil & Water Piping - Fuel Oil - Gaskets & Bolting	X	X		Fuel Oil Injection
02-717M	Aux Sub Base & Oil & Water Piping - Fuel Oil: Supports	X	X		Fuel Oil Injection
02-717N	Jack Water Heat Exchanger	X	X		Jacket Water
02-717O	Lube Oil Heat Exchanger	X	X		Lube Oil
02-717P	Intake Air Silencer		X		Turbo, Intake Intrclr & Exhaust
02-717Q	Jacket Water Standby Heater Pump		X		Jacket Water
02-717R	Before & After Lube Oil Pump	X	X		Lube Oil
02-717S	Oil Prelube Filter	X	X		Lube Oil
02-717T	Auxiliary Jacket Water Pump		X		Jacket Water

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-717U	Lube Oil System Aux. Lube Oil Pump		X		Lube Oil
02-717V	Lube Oil System - Lube Oil Keepwarm Strainer	X	X		Lube Oil
02-717W	Fuel Oil System - Fuel Oil Duplex Strainer		X		Fuel Oil
02-805A	Intake Air Silencer		X		Turbo, Intake, Intercooler & Exhaust
02-805B	Intake Air Filter	X	X		Turbo, Intake, Intercooler & Exhaust
02-805C	Exhaust Silencer			X	
02-805D	Flex Connections	X	X		Turbo, Intake, Intercooler & Exhaust
02-810A	Thermostatic Valve	X	X		Jacket Water
02-810B	Misc. Equipment-Heater, Jacket Water		X		Jacket Water
02-820A	Misc. Equipment - Heater, Lube Oil Sump Tank		X		Lube Oil
02-835A	Skid Base - Starting Air Equipment	X	X		Air Start & Barring Device
02-835B	Starting Air Compressor			X	
02-835C	Misc. Equipment: After Cooler			X	
02-835D	Misc. Equipment: After Cooler Support			X	
02-835E	Misc. Equipment: After Cooler Bolting			X	

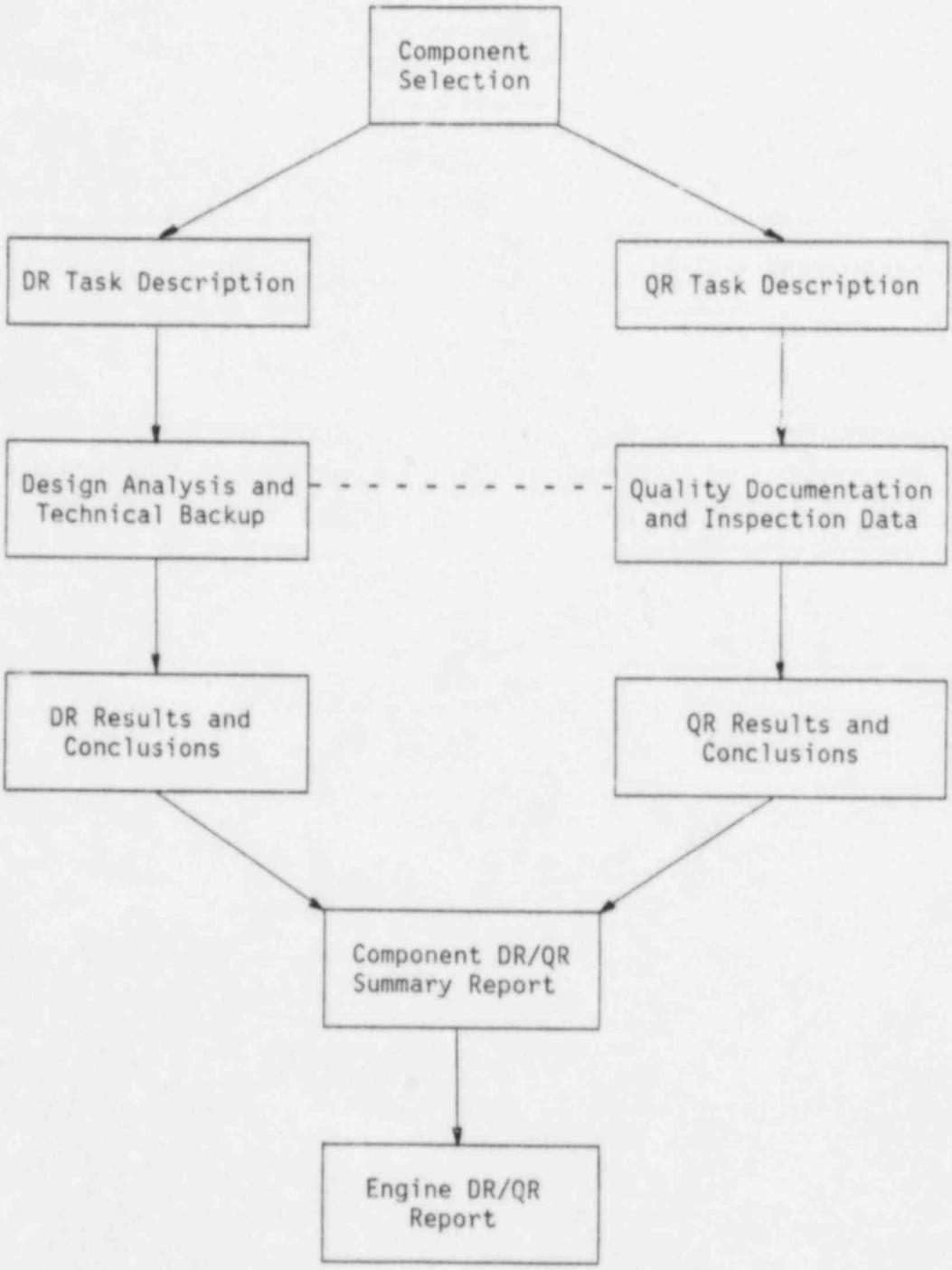
TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
02-835F	Starting Air Tank	X	X		Air Start & Barring Device
02-835G	Air Dryer			X	
02-835H	Air Start Tank Relief Valve	X	X		Air Start & Barring Device
02-835I	Air Start System - Starting Air Piping, Fittings, Tubing			X	
02-835J	Starting Air Float Trap	X			Air Start & Barring Device
02-835K	Fuel Oil System - Fuel Oil Drip Waste Pump			X	
02-835L	Fuel Oil System - Fuel Oil Valves, Bolting			X	
84-101A	Emergency Diesel Generator	X	X		Generator
84-101B	Generator: Shaft & Bearings	X	X		Generator
84-111	Intake Air Filter	X	X		Turbo, Intake, Interclr. & Exhaust
84-113	Exhaust Silencer			X	
84-114	Flex Connections	X	X		Turbo, Intake, Interclr. & Exhaust
84-115	Full Flow Lube Oil Filter	X	X		Lube Oil
84-120	Fuel Oil Booster Pump - D.C. Motor Driven			X	

TABLE 2-2
WPPSS - NUCLEAR PROJECT 1 COMPONENT SELECTION RESULTS

Component Number	Component Description	DR Req'd	QR Req'd	No Review	Category
84-121	Generator Control	X	X		Generator
84-124	DC Magnetic Starter			X	
84-140	Fuel Oil Day Tank	X	X		Fuel Oil

FIGURE 2.1


Component Selection
DR Task Description
QR Task Description
Design Analysis and Technical Backup
Quality Documentation and Inspection Data
DR Results and Conclusions
QR Results and Conclusions
Component DR/QR Summary Report
Engine DR/QR Report

3.0 Results of Design Review and Quality Revalidation

The DR/QR Program implemented for the Washington Public Power Supply System Nuclear Project No. 1 TDI diesels was consistently performed with the generic methodology described in Section 2.0. The results of these reviews are summarized in this section. More detailed component summary reports are contained in Appendix I of this report.

Section 3.1 and 3.2 list the components of the WNP-1 diesel generators which have been reviewed under Phase I and Phase II respectively. The majority of these components are assessed to be acceptable for their intended service with unlimited life provided the recommendations identified are followed. These recommendations deal mainly with additional inspection requirements, and installation, operating and maintenance procedure improvements. In some cases, procurement specification recommendations are identified to aid the utility in its spare parts program.

Some of the components required modifications as identified in the recommended actions. The implementation of these recommended actions by the utility will result in a component which is acceptable for its intended service with unlimited life.

3.1 Summary Resolution of Sixteen Generic Components (Phase I)

The results of the Phase I program have been submitted to the NRC in a series of reports and supplements (Refs. 2 through 34) which covered the 16 generic components. The results of these reviews are summarized below.

Component	Acceptability	Recommended Action
Turbocharger (MP-022/3)	Unlimited Life	Additional testing and maintenance requirements. Revision of operating procedures.
Base and Bearing Caps (03-305A, 03-305C, 03-305D)	Unlimited Life	Additional maintenance and inspection requirements.
Crankshaft (03-310A)	Unlimited Life	None
Cylinder Block and Liner (03-315A, 03-315C)	Unlimited Life	Additional maintenance and inspection requirements.
Cylinder Head Studs (03-315E)	Unlimited Life	None
Connecting Rods: Connecting Rods and Bushings (03-340A)	Unlimited Life	Additional inspection requirements.
Connecting Rod Bearing Shells (03-340B)	Unlimited Life	Additional maintenance requirements. Additional inspections recommended.
Pistons (03-341A)	Unlimited Life	AN piston skirt should be replaced with AE piston skirt.
Air Start Valve (03-359)	Unlimited Life	Additional maintenance requirements. Verification of dimensions recommended.
Cylinder Heads (03-360A)	Unlimited Life	Additional maintenance requirements.

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Component	Acceptability	Recommended Action
Main and Connector Pushrods (03-390C, 03-390D)	Unlimited Life	Additional procurement requirement. Additional inspections recommended. Random destructive testing recommended.
Rocker Arm Capscrews (03-390F)	Unlimited Life	Additional maintenance requirements.
Jacket Water Pump (03-425A)	Unlimited Life	Additional maintenance requirements.
Wiring and Terminations (03-688B)	Unlimited Life	None

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3.2 Summary Resolution of Phase II Components

Component	Acceptability	Recommended Action
TURBO, INTAKE, INTERCOOLER & EXHAUST		
Intercooler (F-068)	Unlimited Life	Additional maintenance recommendations.
Turbocharger (MP-022/023)	Modifications	Additional Quality inspections recommended. Additional maintenance and modification recommendations to increase reliability and performance.
Turbocharger Thrust Bearing Lubrication System (02-CFR)	Modifications	The maximum tubing span length should not exceed 3'-6" in order to minimize the effects of turbocharger operting vibrations. The first support should be as close to the sight glass as practical. The ¼" tubing from the sight glass to the cross should have a lateral offset to accommodate thermal expansion. There should be a minimum 6" offset around bends to accommodate thermal expansion.
Intake Manifold & Piping (Large Bore Scope Only) (02-375)	Modifications	Ensure U-bolts on the crossover piping are properly installed. Additional maintenance recommendations. Additional Quality inspections recommended.
Exhaust Manifold (02-380A)	Modifications	Modify slip joints. Refer to Component Design Review Checklist 02-380A for details. Additional maintenance recommendations.
Exhaust Manifold: Gasket & Bolting (02-380B)	Unlimited Life	Additional Quality inspections recommended.

Component	Acceptability	Recommended Action
Intercooler Piping - Pipe (Large Bore Scope Only) (02-436A&B)	Unlimited Life	None
Turbo Water Piping-Pipe and Fittings (Small Bore Scope Only) (02-437)	Unlimited Life	Additional maintenance recommendations.
Intake Air Silencer (02-717P)	Unlimited Life	None
Intake Air Filters (84-111)	Unlimited Life	Additional maintenance recommendations.
Flex Connections (84-114)	Unlimited Life	None
	LUBE OIL	
Lube Oil Full Pressure Strainer (SE-025)	Unlimited Life	Additional maintenance recommendations.
Lube Oil Pressure Regulating Valve (00-420)	Unlimited Life	Additional maintenance recommendations.
Lube Oil Fittings Internal Headers (Large Bore Scope Only) (02-307A-LB)	Unlimited Life	None
Lube Oil Fittings-Internal: Headers (Small Bore Scope Only) (02-307A-SB)	Unlimited Life	Verify supports as indicated in 02-307D.
Lube Oil Fittings-Internal-Tubing and Fittings (Small Bore Scope Only) (02-307B)	Unlimited Life	None

Component	Acceptability	Recommended Action
Lube Oil Fittings Internal-Supports (Small Bore Scope Only) (02-307D)	Modifications	Modify supports. Refer to Component Design Review Checklist 02-307D for details.
Engine Driven Lube Oil Pump (02-420)	Modifications	Addition of a Style 90 or 165 Dresser coupling with Viton gaskets to the pump suction line.
Lube Oil Lines - External Tubing, Fittings, Coupling (Large Bore Scope Only) (02-465A-LB)	Unlimited Life	Additional maintenance recommendations.
Lube Oil Lines - External - Tubing, Fittings, Coupling (Small Bore Scope Only) (02-465A-SB)	Modifications	Addition/modification of supports. Refer to DR/QR report 02-465B for details.
Lube Oil Liner - External Supports (Large Bore Scope Only) (02-465B-LB)	There are no supports for this component at WNP-1. No design review required.	
Lube Oil Lines External: Supports (Small Bore Scope Only) (02-465B-SB)	Modifications	Addition/modification of supports. Refer to DR/QR Report 02-465B for details.
Lube Oil Lines External - Valves (02-465C)	Unlimited Life	None
Turbocharger - Lube Oil Fitting Piping (Large Bore Scope Only) (02-467A-LB)	Modifications	Replace 2½-inch Dresser couplings (located between the turbocharger and lube oil sump tank) with 2½-inch 150 lb S.O. Flanges with A307 bolts.

Component	Acceptability	Recommended Action
Turbocharger-Lube Oil Fittings-Pipe, Tubing, Fittings, and Flexible Couplings (Small Bore Scope Only) (02-467A-SB)	Modifications	Addition/modification of supports as indicated in DR/QR report 02-467B.
Turbocharger - Lube Oil Fittings: Supports (Large Bore Scope Only) (02-467B-LB)	Modifications	Reinforcement of support members and increases in their welds of multiple support located between the lube oil sump tank and Dresser coupling.
Turbocharger - Lube Oil Fittings: Supports (Small Bore Scope Only) (02-467B-SB)	Modifications	Addition/modification of supports. Refer to DR/QR Report 02-467B for details.
Turbocharger - Bracket: Bolting and Gaskets (02-475A&C)	Unlimited Life	Additional Quality Revalidation inspections recommended.
Turbocharger - Bracket: Air Butterfly Valve Assembly (02-475B)	Modifications	Addition of grease fittings per TDI SIM 322. Additional maintenance recommendations. Additional Quality inspections recommended.
Lube Oil Sump Tank and Mounting Hardware (02-540A&C)	Unlimited Life	Use of the proper bolt torque should be verified per the CQRC for component 02-540C.
Lube Oil Sump Tank-Miscellaneous Fittings, Gaskets, Pipe and Bolting Material, Valve (Small Bore Scope Only) (02-540B)	Unlimited Life	None

Component	Acceptability	Recommended Action
Auxiliary Sub-Base & Oil & Water Piping-Lube Oil: Pipe and Fittings (02-717F)	Modifications	Additional maintenance recommendations. Addition/modification of supports as indicated in DR/QR report 02-717I.
Auxiliary Sub-Base & Oil & Water Piping - Lube Oil: Valves (02-717G)	Unlimited Life	None
Auxiliary Sub-Base & Oil & Water Piping: Lube Oil-Gaskets & Bolting (02-717H)	Unlimited Life	None
Auxiliary Sub-Base & Oil & Water Piping-Lube Oil: Supports & Mounting Hardware (Large Bore Scope Only) (02-717I-LB)	Unlimited Life	None
Auxiliary Sub-Base & Oil & Water Piping - Lube Oil: Supports and Mounting Hardware (Small Bore Scope Only) (02-717I-SB)	Modifications	All restraints should utilize U-bolts of 3/8-inch diameter. Addition of supports. Refer to DR/QR report 02-717I for details.
Lube Oil Heat Exchanger (02-717O)	Unlimited Life	Additional maintenance recommendations.
Before and After Lube Oil Pump (02-717R)	Unlimited Life	Additional inspections recommended.
Oil Prelube Filter (02-717S)	Unlimited Life	Additional maintenance recommendations.

Component	Acceptability	Recommended Action
Lube Oil System-Auxiliary Lube Oil Pump (02-717U)	Unlimited Life	None
Lube Oil System: Lube Oil Keepwarm Strainer (02-717V)	Unlimited Life	Additional maintenance recommendations.
Miscellaneous Equipment-Heater, Lube Oil Sump Tank (02-820A)	Unlimited Life	Additional maintenance recommendations.
Full Flow Lube Oil Filter (84-115)	Unlimited Life	Additional maintenance recommendations.
ENGINE BASE & BEARING CAPS		
Base and Bearing Caps - Base Assembly, Main Bearing Studs and Nuts, and Main Bearing Caps (02-305A,C,D)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
CRANKSHAFT & BEARINGS		
Crankshaft (02-310A)	Unlimited Life (provided that a torsiograph test verifies that the actual level of stress does not exceed that calculated and that crankshaft inspections verify that the vital area are free of unacceptable flaws)	Additional Quality Revalidation inspections recommended.

Component	Acceptability	Recommended Action
Main Bearings (02-310B)	Unlimited Life	Additional maintenance inspections recommended. Additional Quality inspections recommended.
Crankshaft & Bearings: Thrust Bearing (02-310C)	Unlimited Life	Additional maintenance recommendations.
Crankcase: Crankcase Assembly (02-311A)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Crankcase: Crankcase Mounting Hardware (02-311D)	Unlimited Life	None
Crankcase: Crankcase Gaskets and Mounting Hardware (02-386B)	Unlimited Life	Additional Quality inspections recommended.

CYLINDER BLOCK, LINERS, & WATER MANIFOLD

Cylinder Block (02-315A)	Unlimited Life	Perform a dimensional check on liner bore and mating bock. Implementation of routine inspections.
Cylinder Block Liners & Water Manifold-Cylinder Liner (02-315C)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Jacket Water Manifold Piping (Large Bore Scope Only) (02-315D)	Unlimited Life	None

Component	Acceptability	Recommended Action
Cylinder Block Liners & Water Manifold: Studs (02-315E)	Unlimited Life	Changes to installation torque to lower the stresses in the cylinder block recommended. Additional Quality inspections recommended.
Cylinder Block Liner & Water Manifold- Cylinder Head Nuts (02-315F)	Unlimited Life	Additional Quality Revalidation inspections recommended.
Cylinder Block - Liners and Water Manifold: Seals and Gaskets (02-315G)	Unlimited Life	None
Cylinder Block Covers: Gaskets and Bolting (02-385B)	Unlimited Life	Additional Quality inspections recommended.
	AIRSTART & BARRING DEVICE	
Starting Air Distributor: Distributor Assembly (00-442A)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Starting Air Distributor - Tubing, Fittings, and Gaskets (00-442B)	This component review has been deleted. All air distributor tubing is addressed under component numbers 02-441A&C and 02-307B.	
Air Start Valves (02-359)	Modifications	Implementation of TDI SIMs 329 and 360. Additional maintenance recommendations. Additional Quality inspections recommended.

Component	Acceptability	Recommended Action
Starting Air Manifold: Piping, Tubing, and Fittings (Large Bore Scope Only) (02-441A-LB)	Modifications	Modify supports in order to provide stiffer load paths and to relieve thermal restraint in certain directions by partial support removal through bolt hole elangations. Refer to DR/QR report 02-441A for details.
Starting Air Manifold: Piping, Tubing and Fittings (Small Bore Scope Only) (02-441A-SB)	Modifications	Ensure that the starting air manifold vent is open and effective. Addition/modifications of supports as indicated in DR/QR report 02-441C.
Starting Air Manifold: Valves, Strainers, & Filters (02-441B)	Modifications	Addition of free flowing drains to the air distributor filter. Additional maintenance recommendations.
Starting Air Manifold: Supports (Large Bore Scope Only) (02-441C-LB)	Unlimited Life	None
Starting Air Manifold - Supports (Small Bore Scope Only) (02-441C-SB)	Modifications	Addition/modification of restraints and supports. Refer to DR/QR report 02-441C for details.
Barring Device - Pneumatic: Regulator Valve, Shutoff Valve (02-525B)	Unlimited Life	Additional maintenance recommendations.
Skid Base - Starting Air Equipment (02-835A)	Unlimited Life	None
Starting Air Tank (02-835F)	Unlimited Life	Additional maintenance recommendations.
Air Start Tank Relief Valves (02-835H)	Unlimited Life	None

Component	Acceptability	Recommended Action
Starting Air Float Trap (02-835J)	Unlimited Life	Additional maintenance recommendations.
	CONNECTING RODS	
Connecting Rods: Rods and Bushings (02-340A)	Unlimited Life	Additional maintenance recommendations. Additional Quality Revalidation inspections recommended.
Connecting Rod Bearing Shells (02-340B)	Unlimited Life	Additional maintenance recommendations. Additional Quality Revalidation inspections recommended.
	PISTONS	
Piston (02-341A)	Modifications	Replace all AN piston skirts with the product improvement type AE. Additional Quality inspections recommended.
Piston: Rings (02-341B)	Unlimited Life	Additional maintenance recommendations. Additional Quality Revalidation inspections recommended.
Piston Pin Assembly (02-341C)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
	CAMSHAFT & VALVE TRAIN	
Tappets and Guides: Intake & Exhaust Tappet Assembly (02-345A)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Tappets and Guides: Fuel Tappet Assembly (02-345B)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Tappets and Guides: Pump Base Assembly (02-345C)	Unlimited Life	None

Component	Acceptability	Recommended Action
Camshaft: Camshaft Assembly (02-350A)	Unlimited Life	Additional maintenance recommendations. Additional Quality Revalidation inspections recommended.
Camshaft: Camshaft Bearing (02-350B)	Unlimited Life	None
Camshaft-Supports, Bolting and Gear; Idler Gear Assembly-Crank to Pump Gear; Idler Gear Assembly-Idler Gear Assembly (02-350C 02-355A&B)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Rocker Shaft Assemblies: Intake/Intermediate & Exhaust (02-390A&B)	Unlimited Life	Additional Quality Revalidation inspections recommended.
Main and Connector Pushrods (02-390C&D)	Unlimited Life	Additional Quality inspections recommended.
Rocker Arms & Pushrods: Bushings (02-390E)	Unlimited Life	Additional maintenance recommendations.
Rocker Arms & Pushrods: Lifters (02-390F)	Unlimited Life	Additional Quality Revalidation inspections recommended. Additional maintenance recommendations.
Rocker Arms & Pushrods - Miscellaneous Bolts and Drive Studs (02-390G)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.

Component	Acceptability	Recommended Action
IDLER GEAR ASSEMBLY & FRONT GEAR CASE		
Front Gear Case Bolting (02-335B)	Unlimited Life	Additional Quality inspections recommended.
FLYWHEEL		
Flywheel (02-330A)	Unlimited Life	None
Flywheel Bolting (02-330B)	Unlimited Life	Additional Quality inspections recommended.
ENGINE INSTRUMENTATION & WIRING		
Pyrometer Conduit Assembly Thermocouples (02-630D)	Unlimited Life	Additional maintenance recommendations.
Engine and Auxiliary Module Wiring Material and Fittings Pyrometer Conduit Assembly Conduit Fittings and Supports (02-688A, 02-630A,B,C)	Modifications	Perform an upgrade to tighten/fix, replace or add missing conduit support. Additional supports for flexible conduits recommended.
Engine & Auxiliary Module Wiring Materials: Wiring and Terminations (02-688B)	Modifications	Implementation of TDI SIM No. 361.
Engine & Auxiliary Module Wiring Material - Boxes & Terminals (02-688C)	Unlimited Life	None
Off Engine Alarm Sensor Wiring (02-689)	Unlimited Life	None

Component	Acceptability	Recommended Action
On Engine Alarm Sensors (02-690)	Unlimited Life	None
Off Engine Alarm Sensors (02-691)	Unlimited Life	None
	OVERSPEED TRIP & GOVERNOR	
Overspeed Trip-Governor (02-410A)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Overspeed Trip: Governor and Accessory Drive Assembly (02-410B)	Unlimited Life	Additional Quality Revalidation inspections recommended.
Overspeed Trip: Couplings (Flexible and Spider) (02-410C)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Overspeed Trip Vent Valve (02-410D)	Unlimited Life	Additional maintenance recommendations.
Governor Drive: Governor and Tachometer Drive Gear and Shaft (02-411A)	Unlimited Life	Additional Quality inspections recommended.
Governor Drive: Couplings, Pins, & Keys) (02-411B)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Governor Linkage and Cross Shaft Assembly (02-413A)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.

Component	Acceptability	Recommended Action
Governor Assembly - Woodward Governor (02-415A)	Unlimited Life	Additional maintenance recommendations.
Governor Assembly - Booster Servomotor (02-415B)	Unlimited Life	Additional Quality inspections recommended.
Governor Assembly - Heat Exchanger (02-415C)	Unlimited Life	Additional Quality inspections recommended.
ENGINE SHUTDOWN & EQUIPMENT		
Engine Shutdown Equipment - Tubing/ Fittings and Supports (Small Bore Scope Only) (02-695A)	Modifications	Addition/modification of supports. Refer to DR/QR report 02-695A for details.
Engine Shutdown Equipment - Valves, Regulators, Orifices (02-695B)	Unlimited Life	Additional maintenance recommendations.
Engine Shutdown Trip Switches (02-695C)	Unlimited Life	None
JACKET WATER		
Jacket Water Standpipe and Miscellaneous Bolting (00-700E)	Unlimited Life	Additional inspections recommended.
Jacket Water Manifold - Manifold Assembly with Hardware Coupling and Gaskets (Large Bore Scope Only) (02-316A&B)	Modifications	The tie rod assembly surrounding the 6-inch Dresser coupling requires double-nutting to prevent inward axial movement. Addition of 1-inch diameter rods. The second support west of the 6-inch TDI custom flanges requires stiffening in the lateral direction. Additional maintenance recommendations.

Component	Acceptability	Recommended Action
Jacket Water Inlet Manifold: Manifold - Vent Lines to Discharge Manifold (02-316C)	Modifications	Modify supports to ensure sufficient moment connection at the support to structural steel interface.
Jacket Water Discharge Manifold Piping (Large Bore Scope Only) (02-317A&B)	Modifications	Replace Style 65 Dresser couplings with Dresser Style 90 or Style 165 coupling equipped with Viton gaskets.
Water Discharge Manifold/Supports (Large Bore Scope Only) (02-317C)	Modifications	Ensure that the supports (attached to the water jacket shroud) on the two 5-inch headers have a minimum weld of 3-inches long on both sides to the longer end of the plate. Also, ensure that the welds between the existing 3/4-inch plate and engine block have a minimum weld of ¼-inch along the total width of the plate.
Engine Driven Jacket Water Pump (02-425A)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Jacket Water Fittings - Pipe and Fittings (Large Bore Scope Only) (02-435A-LB)	Modifications	Ensure flange bolts are A-325 or better. 1
Jacket Water Fittings - Pipe and Fittings (Small Bore Scope Only) (02-435A-SB)	Unlimited Life	Additional maintenance recommendations. Additional installation recommendations.

Component	Acceptability	Recommended Action
Jacket Water Inlet Manifold: Manifold - Vent Lines to Discharge Manifold (02-316C)	Modifications	Modify supports to ensure sufficient moment connection at the support to structural steel interface.
Jacket Water Discharge Manifold Piping (Large Bore Scope Only) (02-317A&B)	Modifications	Replace Style 65 Dresser couplings with Dresser Style 90 or Style 165 coupling equipped with Viton gaskets.
Water Discharge Manifold/Supports (Large Bore Scope Only) (02-317C)	Modifications	Ensure that the supports (attached to the water jacket shroud) on the two 5-inch headers have a minimum weld of 3-inches long on both sides to the longer end of the plate. Also, ensure that the welds between the existing 3/4-inch plate and engine block have a minimum weld of ¼-inch along the total width of the plate.
Engine Driven Jacket Water Pump (02-425A)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Jacket Water Fittings - Pipe and Fittings (Large Bore Scope Only) (02-435A-LB)	Modifications	Reinforcement of support members. Refer to DR/QR report 02-435A for details.
Jacket Water Fittings - Pipe and Fittings (Small Bore Scope Only) (02-435A-SB)	Unlimited Life	Additional maintenance recommendations. Additional installation recommendations.

Component	Acceptability	Recommended Action
Jacket Water Fittings - Supports Exhaust Manifold (Large Bore Scope Only) (02-435B-LB)	Unlimited Life	None
Jacket Water Fittings - Supports (Small Bore Scope Only) (02-435B)	Unlimited Life	None
Jacket Water Inlet Fittings - Valves (02-435C)	Unlimited Life	None
Jacket Water Standpipe: Pipe, Fittings and Gaskets (Small Bore Scope Only) (02-700A)	Modifications	The jacket water vent lines of the air bubble removal system should be installed in accordance with TDI Drawing No. 09-810-75084. Addition/modification of supports as indicated in DR/QR Report 02-700B.
Jacket Water Standpipe - Supports (Small Bore Scope Only) (02-700B)	Modifications	Modification of supports. The jacket water vent lines of the air bubble removal system should be installed utilizing two-directional restraints at a maximum spacing of 4 ft - 6 in. for ¼-inch diameter tubing and 5 ft - 0 inch for 3/8 inch diameter tubing.
Jacket Water Standpipe Switches (02-700D)	Unlimited Life	None

Component	Acceptability	Recommended Action
Auxiliary Sub-Base & Oil & Water Piping-Jacket Water: Valves (02-717B)	Unlimited Life	Inspect the valves for packing leakage monthly.
Auxiliary Sub-Base & Oil & Water Piping-Jacket Water: Pipe, Couplings, Fittings, Orifices and Strainers (Large Bore Scope Only) (02-717C-LB)	Unlimited Life	None
Auxiliary Sub-Base & Oil & Water Piping-Jacket Water: Pipe, Couplings, Fittings (Small Bore Scope Only) (02-717C-SB)	Modifications	Addition/modification of supports as indicated in DR/QR report 02-717E.
Auxiliary Sub-Base & Oil & Water Piping-Jacket Water: Gaskets and Bolting (02-717D)	Unlimited Life	None
Auxiliary Sub-Base & Oil & Water Piping - Jacket Water: Supports (Large Bore Scope Only) (02-717E-LB)	Unlimited Life	None
Auxiliary Sub-Base & Oil & Water Piping-Jacket Water: Supports (Small Bore Scope Only) (02-717E-SB)	Modifications	Installation of this component should be completed by the installation of restraints as shown on TDI Drawing 101419. All U-bolts should be replaced with 3/8-inch diameter U-bolts having proper locking devices and installed to provide a proper sliding fit.

Component	Acceptability	Recommended Action
Jacket Water Heat Exchanger (02-717N)	Unlimited Life	Additional maintenance recommendations.
Jacket Water Standby Heater Pump (02-717Q)	Unlimited Life	None
Auxiliary Jacket Water Pump (02-717T)	Unlimited Life	None
Thermostatic Valves (02-810A)	Unlimited Life	Additional maintenance recommendations.
Miscellaneous Equipment - Heater, Jacket Water (02-810B)	Unlimited Life	Additional maintenance recommendations.
CYLINDER HEADS & VALVES		
Cylinder Heads (02-360A)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Cylinder Head Valves: Intake and Exhaust Valves (02-360B)	Unlimited Life	Additional Quality Revalidation inspections recommended.
Cylinder Head and Valves: Bolting and Gaskets (02-360C)	Unlimited Life	Additional Quality Revalidation inspections recommended.

Component	Acceptability	Recommended Action
Cylinder Head and Valves: Springs and Retainers (02-360D)	Unlimited Life	Additional Quality Revalidation inspections recommended.
Cylinder Head Covers: Subcover Assembly (02-362A)	Unlimited Life	Additional Quality inspections recommended.
	FUEL OIL INJECTION	
Fuel Oil Drip Tank Assembly (00-621A)	Unlimited Life	None
Fuel Injection Equipment: Fuel Injection Pump (02-365A)	Unlimited Life	Additional maintenance recommendations.
Fuel Injection Equipment: Fuel Injection Tips (02-365B)	Unlimited Life	Additional maintenance recommendations.
Fuel Injection Equipment - Tube Assembly (02-365C)	Unlimited Life	Inspect compression fittings at both ends of each fuel injection line.
Fuel Injection Equipment: Supports (Small Bore Scope Only) (02-365D)	Unlimited Life	Additional maintenance recommendations.
Fuel Pump Linkage: Fuel Pump Control Shaft; Linkage Assembly & Bearings (02-371A&B)	Unlimited Life	Additional maintenance recommendations. Additional Quality inspections recommended.
Fuel Pump Linkage: Automatic Shutdown Cylinder (02-413B)	Unlimited Life	None

Component	Acceptability	Recommended Action
Fuel Oil Booster Pump (02-445)	Unlimited Life	None
Fuel Oil Header: Piping/ Tubing (Small Bore Scope Only) (02-450A)	Modifications	Replace 1-inch threadolet with socket welded tee. Addition/modification of supports as indicated in DR/QR report 02-450B.
Fuel Oil Header-Fuel Oil Supports (Small Bore Scope Only) (02-450B)	Modifications	Addition/modification of restraints and supports. Refer to DR/QR report 02-450B for details.
Fuel Oil Filters & Strainers: Filters (02-455A)	Unlimited Life	Additional maintenance recommendations.
Fuel Oil Filters & Strainers: Strainers (02-455B)	Unlimited Life	Additional maintenance recommendations.
Fuel Oil Filters and Strainers: Mounting Hardware (02-455C)	Unlimited Life	None
Auxiliary Sub-Base & Oil & Water Piping-Fuel Oil: Piping and Fittings (Small Bore Scope Only) (02-717J-SB)	Modifications	Addition/modification of supports as indicated in DR/QR report 02-717M.
Auxiliary Sub-Base & Oil & Water Piping: Fuel Oil Valves (02-717K)	Unlimited Life	Inspect and clean valves at each plant refueling outage. Verify that the relief valves have been installed in a vertical position per the manufacturer's recommend-ations.

Component	Acceptability	Recommended Action
Auxiliary Sub-Base & Oil & Water Piping - Fuel Oil: Bolting and Gaskets (02-717L)	Unlimited Life	None
Auxiliary Sub-Base & Oil & Water Piping - Fuel Oil: Supports (Small Bore Scope Only) (02-717M)	Modifications	Addition/modification of supports and restraints. Refer to DR/QR report 02-717M for details.
Fuel Oil System - Fuel Oil Duplex Strainer (02-717W)	Unlimited Life	None
Fuel Oil System - Fuel Oil Day Tank (84-140)	Unlimited Life	None
GENERATOR		
Emergency Diesel Generator (84-101A)	Unlimited Life	None
Generator: Shaft & Bearings (84-101B)	Unlimited Life	None
Generator Controls (84-121)	Modifications	Review design of circuits. Replacement of field flashing relay recommended. Additional maintenance/ modification recommendations to increase long-term reliability and performance. Refer to DR/QR Report 84-121 for details.
CONTROL PANEL ASSEMBLY		
Control Panel Assembly - Cabinet/System (02-500A)	Unlimited Life	None

Component	Acceptability	Recommended Action
Control Panel Assembly - Accumulator (02-500F)	Unlimited Life	None
Control Panel Valves (02-500G)	Unlimited Life	Additional maintenance recommendations.
Control Panel Assembly - Pressure Switches (02-500H)	Unlimited Life	None
Control Panel Assembly - Control Relays (02-500J)	Unlimited Life	None
Control Panel Assembly - Solenoid Valves (02-500K)	Unlimited Life	None
Control Panel Assembly - Piping, Tubing & Fittings (02-500M)	Unlimited Life	None
Control Panel Assembly-Terminal Boards/Switches, Wiring (02-500N)	Unlimited Life	Verify that no Multi-Amp, States Division terminal blocks, manufactured between 1974 and 1975, are installed.
AUXILIARY SUB-BASE & FOUNDATION BOLTS		
Foundation Bolts - Anchor Bolts, Miscellaneous Hardware (02-550)	Unlimited Life	Additional maintenance recommendations.
Auxiliary Skid (02-717A)	Unlimited Life	None

4.0 SUMMARY/CONCLUSIONS

The TDI Diesel Generator Owners Group has completed its review of the TDI diesel generators installed at WPPSS - Nuclear Project 1.

The scope and depth of this review as outlined in this report represents a significant effort by the TDI Diesel Generator Owners Group Technical Staff and Washington Public Power Supply System.

Nuclear standby diesel generator reliability has been a major concern of the industry and the NRC. Although previous programs have been sponsored by the NRC, EPRI, and other industry groups to quantify and improve this reliability, the Design Review and Quality Revalidation effort summarized in this report is unprecedented in its approach and analytical detail. This effort has produced a detailed assessment of 174 TDI diesel generator components. Many of these components have been analyzed using analytical techniques which exceed the detailed engineering effort of the original design.

Extensive component inspections are an integral part of the DR/QR program. The performance of these inspections leaves no doubt as to the quality of these critical diesel generator components.

Thus, the TDI Diesel Generator Owners Group effort has gone a long way toward quantifying the reliability of the TDI Diesel Generator by establishing the acceptability of these critical engine components. In many cases, recommendations are made to improve component reliability and therefore improve overall diesel generator reliability.

The TDI Diesel Generator Owners Group believes that this extensive effort verifies the acceptability of the TDI diesel generators for nuclear service.

The results of this review, as outlined in Section 3.0 of this report, show that the important components of the TDI diesel generator have been assessed to be adequate for their intended function. In cases where component adequacy has been judged to be marginal, corrective action is recommended which will ensure the adequacy of the component.

This report supports the conclusion that the TDI diesel generators installed at WPPSS - Nuclear Project 1 are acceptable for their intended safety related function and, in addition, the incorporation of the maintenance and surveillance recommendations into the plant's existing program provides added assurance that these diesel generators will continue to perform their intended function for the life of the plant.

5.0 RECOMMENDATIONS

The purpose of the TDI Diesel Generator Owners Group Program was to assess the acceptability of the TDI Emergency Diesel Generator at WPPSS-Nuclear Project 1 and to make recommendations as required to improve the reliability of given components. These recommendations are summarized in section 3.0 and given in detail in Appendix I.

Additionally, the TDI Diesel Generator Owners Group Program has made recommendations concerning component maintenance and surveillance. These recommendations have been assembled from manufacturers manuals and the component DR/QR summary reports. These maintenance and surveillance recommendations are outlined in Appendix II.

Although the recommendations of this report are not requirements, their adoption by Washington Public Power Supply System will give added assurance that the TDI Emergency Diesel Generators installed at WPPSS - Nuclear Project 1 will perform their intended function for the life of the plant. These recommendations represent a conservative approach to insuring diesel generator reliability. In some cases, the utility may propose alternate means of insuring the reliability of their emergency diesel engines. Justification of these alternate means is the responsibility of the utility.

6.0 REFERENCES

Component DR/QR Summary Reports list references directly related to that component.

Ref. #			
1	TDI-3	12-10-84	TDI Owners Group Program Plan, Rev. 1
2	TDI-2	2-27-84	Investigation of Types AF and AE Piston Skirts
3	TDI-4	3-12-84	D.R. of Connecting Rod Bearing Shells.
4	TDI-5	3-13-84	TDI D.G. Rocker Arm Capscrew Stress Analysis Report
5	TDI-6	3-23-84	TDI D.G. Air Start Valve Capscrew Dimensional and Stress Analysis Report
6	TDI-8	3-30-84	TDI D.G. Cylinder Head Stud Stress Analysis
7	TDI-14	4-13-84	TDI D.G. Supplement to the Cylinder Head Stud Stress Analysis and Supplement to the Air Start Valve Capscrew Dimension and Stress Analysis
8	TDI-15	4-16-84	TDI D.G. Report on Engine Driven Jacket Water Pump Design Review
9	TDI-16	4-19-84	TDI D.G. Report on Push Rods
10	TDI-17	4-20-84	TDI D.G. Report on the Evaluation of Emergency D.G. Crankshafts at Shoreham
11	TDI-18	4-24-84	TDI D.G. Report on the Evaluation of Emergency D.G. Wiring and Terminations of Shoreham
12	TDI-19	4-24-84	TDI D.G. Supplement to the Rocker Arm Capscrew Stress Analysis
13	OGTP-8	4-27-84	TDI D.G. Report on Fuel Injection Tubing Qualification Analysis
14	OGTP-9	5-14-84	TDI D.G. Report on D.R. of Connecting Rods of Inline DSR-48 Emergency D.G.
15	OGTP-10	4-27-84	TDI D.G. Report on D.R. of Engine Base and Bearing Caps
16	OGTP-25	5-14-84	TDI D.G. Cylinder Head Report

Ref. #			
17	OGTP-26	5-14-84	TDI D.G. Turbocharger Report
18	OGTP-39	5-24-84	Evaluation of Emergency D.G. Crankshafts at Shoreham and Grand Gulf Nuclear Power Station
19	OGTP-40	5-24-84	D.R. of Connecting Rods for TDI DSRV-4 Series Diesel Generators
20	OGTP-41	5-24-84	Investigation of Types AF & AE Piston Skirts
21	OGTP-57	6-05-84	Emergency D.G. Aux. Module Control Wiring and Termination Qualification Report for G.G.N.S.
22	OGTP-70	6-13-84	Emergency D.G. Aux. Module Control Wiring and Termination Qualification Report for C.P.S.E.S.
23	OGTP-72	6-14-84	The Infulence of Thermal Distortion on the Performance of AF and AE Piston Skirts
24	OGTP-74	6-15-84	EDG Aux. Module Control Wiring and Termination Qualification Report for Shearon Harris Nuclear Power Station Unit I
25	OGTP-76	6-15-84	Evaluation of E.D.G. Crankshafts at Midland and Shearon Harris Nuclear Generating Stations
26	OGTP-77	6-15-84	DR of Elliott Model 656 Turbocharger used on TDI DSRV-12-4 and DSRV-20-4 EDG sets
27	OGTP-79	6-18-84	DR of Connecting Rods of TDI Inline DSR-48 EDG
28	OGTP-80	6-18-84	DR of Engine Base and Bearing Caps for TDI DSRV-16 Diesel Engines
29	OGTP-90	6-25-84	DR of TDI R-4 and RV-4 series EDG Cylinder Blocks and Liners
30	OGTP-89	6-22-84	DR of Connecting Rod Bearing Shells for Transamerica Delavel Enterprise Engines
31	OGTP-111	7-6-84	Supplement to the Emergency Diesel Generator Engine Driven Jacket Water Pump Design Review
32	OGTP-129	7-24-84	Emergency D.G. Rocker Arm Capscrews Stress Analysis
33	OGTP-140	7-27-84	Report on Emergency D.G. Auxiliary Control Module Control Wiring & Termination Review
34	OGTP-147	8-1-84	Design Review of Elliott Model 65G Turbocharger used on TDI DSRV-12-4 & DSRV-20-4 Emergency D.G. Sets

Ref. #			
35	OGTP-181	8-10-84	Design Review of Engine Base and Bearing Caps for TDI DSRV-16 Diesel Engines
36	OGTP-190	8-14-84	Design Review of Elliott Model 90G Turbocharger used on TDI DSR-48 and DSRV-16 Emergency Diesel Generator Sets
37	OGTP-260	9-7-84	Design Review of Connecting Rods for TDI DSRV-4 Series Diesel Generators
38	OGTP-261	9-7-84	Design Review of Engine Base and Bearing Caps for TDI Diesel Engines
39	OGTP-263	9-7-84	Evaluation of Cylinder Heads of TDI Series R-4 Diesel Engines
40	OGTP-306	9-28-84	Survey of Start Experiences and Cause of Unscheduled Shutdowns of TDI Diesel Engines
41	OGTP-403	10-17-84	Baseline Vibration Survey for Shoreham Nuclear Power Station DG 101
42	OGTP-485	11-6-84	Design Review of Connecting Rod Bearing Shells for TDI Engines, March 12, 1984
43	OGTP-591	11-27-84	Phase I Report - Turbocharger - Nozzle Ring Supplement for DSR-48 and DSRV-16-4 Engines
44	OGTP-593	11-27-84	Investigation of Types AN and AH Piston Skirts

TDI DIESEL GENERATOR

DESIGN REVIEW AND QUALITY REVALIDATION REPORT

Prepared For

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

WPPSS NUCLEAR PROJECT 1

By

TDI DIESEL GENERATOR OWNERS GROUP

VOLUME 2

How To Use This Report

Tabs in this report identify the following categories:

Turbo, Intake, Intercooler & Exhaust
Lube Oil
Engine Base & Bearing Caps
Crankshaft & Bearings
Cylinder Block, Liners & Water Manifold
Air Start & Barring Device
Connecting rods
Pistons
Camshaft & Valve Train
Idler Gear Assembly & Front Gear Case
Flywheel
Engine Instrumentation & Wiring
Overspeed Trip & Governor
Engine Shutdown & Equipment
Jacket Water
Cylinder Heads & Valves
Fuel Oil Injection
Generator
Control Panel Assembly
Engine & Auxiliary Sub-Base & Foundation Bolts

These categories have been defined to allow the reader to review a complete diesel generator subsystem in a convenient manner.

Within each category tabs identify WPPSS Nuclear Project 1 specific component numbers.

A given component report can be found by:

a) If the component number is known - use the alpha - numberic index which identifies the volume number and category in which the component report is located.

b) If only the component name is known - Section 3.2 may be used as a cross-reference to find the volume number where the component report may be found.

Some reports address more than one component. a tab is provided for each component. However, some components are combined under one report. Slip sheets are provided where required to reference back to the appropriate tab. Some components required more than one report. These are identified by the abbreviation LB-Large Bore and SB-Small Bore on the component number tabs.

For the purpose of writing this report, the WPPSS Nuclear Project 1 engines were designated as A and B. The relation of these designations to other plant numbers associated with the engines is given in the table below.

Report Designation	Plant Mark Number	Engine Serial Number
A	EDG-DG-1-B	75084
B	EDG-DG-2-A	75085

Component Number	Component Description	Category	Volume No.
F-068	Intercooler	Turbo, Intake Intrclr. & Exhaust	-
MP022/23	Turbocharger	Turbo, Intake, Intrclr. & Ex[illegible]	[illegible]
SE-025	Lube Oil Full Pressure Strainer	Lube Oil	[illegible]
00-420	Lube Oil Pressure Regulating Valve	Lube Oil	2
00-442A	Starting Air Distributor: Distributor Assembly	Air Start & Barring Device	3
00-442B	Starting Air Distributor: Tubing, Fittings, Gaskets	Air Start & Barring Device	3
00-621A	Fuel Oil Drip Tank Assembly	Fuel Oil Injection	4
02-CFR	Turbocharger Thrust Bearing Lubrication System	Turbo, Intake, Intrclr. & Exhaust	2
02-305A	Base and Bearing Caps: Base Assembly	Engine Base & Bearing Caps	2
02-305C	Base and Bearing Caps: Main Bearing Studs & Nuts	Engine Base & Bearing Caps	2
02-305D	Base and Bearing Caps: Main Bearing Caps	Engine Base & Bearing Caps	2
02-307A	Lube Oil Fittings: Internal - Headers	Lube Oil	2
02-307B	Lube Oil Fittings: Internal - Tubing & Fittings	Lube Oil	2
02-307D	Lube Oil Fittings Internal: Supports	Lube Oil	2
02-310A	Crankshaft	Crankshaft & Bearings	2

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Intercooler

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. F-068

TASK DESCRIPTION NO. DR-12-F-068-1

SNPS GPL NO. F-068

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that already addressed in the lead engine report. There was no site experience in the Component Tracking System. Nuclear and non-nuclear industry experience shows a number of intercooler problems mainly due to engine vibration. TDI has issued SIM No. 365, which contains suggested modifications to prevent intercooler problems such as these, and it is recommended that this SIM be implemented at WNP-1.
- A review of the lead engine DR/QR report (Comanche Peak).
- Both WNP-1 and Comanche Peak intercoolers were manufactured by Young Radiator and are Model No. D264836.

There are no modifications required for this component, based on the lead engine report.

The following maintenance recommendations from the lead engine DR/QR report should be implemented:

- The intercooler should be inspected for external leaks every month.
- The intercooler should be disassembled as necessary and cleaned every refueling outage.
- The drain connection on the air intake system low point should be verified open and cleaned daily.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER J C Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Turbocharger UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. MP-022/23 TASK DESCRIPTION NO: DR-12-MP-022/23-0

SNPS GPL NO. MP-017 CLASSIFICATION TYPE A

TASK DESCRIPTIONS

A design review for this component is not required, based on the following:

- Design reviews for the lead engines, Shoreham and Comanche Peak, as well as Grand Gulf and Catawba, establish the acceptability of the Elliott Model BCO-90G turbocharger. This model turbocharger is used on all Owners Group DSRV-16 and DSR-48 diesel engines.

- The turbocharger operating conditions at WNP-1 are approximately equal to those at Comanche Peak and other Owners Group DSRV-16 and DSR-48 diesel engines with full load ratings of 225 BMEP.

- The lube oil system is similar to Comanche Peak and Grand Gulf. These engines have a full flow auxiliary oil pump that can be started before diesel start up to assure turbocharger bearing lubrication.

The EDG Component Tracking System was reviewed for any applicable experience. The primary adverse experience associated with the turbocharger was rapid thrust bearing wear and broken nozzle ring capscrews and vanes. The thrust bearing wear was attributed to insufficient lubrication prior to engine start. Nozzle ring vane failures were due to high cycle fatigue arising either from diesel engine exhaust gas pulsations or vibration during operation. The capscrews failed by means of intergranular cracking as the result of improper heat treatment during manufacturing, or in another case, due to high cycle fatigue, probably from improper torquing during assembly. Vane failures have not affected engine operability in the past and capscrew failures are rare events and are not expected to recur provided that the installation torque is to specification and that manufacturing defects are not present. Thus, the current nozzle ring and attachment design is adequate for nuclear standby service.

The following Quality inspections should be performed on both station engines:

- Perform a visual inspection on the bearings and nozzle ring for signs of wear and cracks.

- Determine the end clearances (Rotor Float).

TASK DESCRIPTIONS (continued)

- Verify that the proper number of bolts on the turbine inlet casing are installed.

- Verify that the proper torque loads are applied to the bolts of the turbine inlet casing.

- Perform a liquid penetrant test on the stationary nozzle ring for signs of adverse wear and cracking.

- Verify that SIM 300 was implemented and perform a liquid penetrant test on the welds retaining the core plug (hub nut). In addition, verify that the core plug is staked.

The following maintenance and modification recommendations were recommended in previous DR/QR reports and apply to the turbochargers at WNP-1 as well. These maintenance adn modification recommendations will help assure turbocharger reliability and performance:

- Revise appropriate operating procedures to use the auxiliary lube oil pump to prelube the turbocharger bearings. Prelube oil flow should be initiated 1 to 2 minutes prior to engine starts, and stopped approximately 30 seconds after the engine reaches rated speed.

- The TDI recommended drip system should be retained for minimizing thrust bearing wear associated with automatic fast starts. The quantity of oil passing through the orifice should be measured and be at least 0.1 gph. Increased flow rates up to 0.35 gph are recommended to improve effectiveness of the drip system.

- For improved confidence in the reliability of the turbocharger, inspection of a thrust bearing for signs of excessive wear should be performed to verify the adequacy of the full flow prelube system. This inspection should be performed on a thrust bearing installed during or after implementation of the full flow prelube system and following an initial 100 engine starts or at the closest plant refueling outage but not to exceed 130 starts.

- The rotor axial clearance should be routinely checked in accordance with the TDI Instruction Manual. In addition, since trends of increasing clearance could signify thrust bearing degradation (even if the total displacement is within specification), any such trends should be reviewed.

- Since the nuclear standby diesel generator sets may undergo non-prelubed automatic fast starts not associated with a potential LOOP/LOCA event, the turbocharger thrust bearings of any WNP-1 engine should be inspected for excessive wear and, if necessary, replaced after experiencing no more than 40 such starts. This recommendation is applicable to all thrust bearings installed.

TASK DESCRIPTIONS (continued)

- Spectrochemical engine oil analysis should be incorporated into the TDI Instruction Manual. In addition, to further expand the preventive monitoring of the turbocharger thrust bearing, ferrographic engine oil analysis may be utilized. Particular attention should be paid to copper level and particulate size, which could signify thrust bearing degradation.

- At any turbocharger disassembly there should be a visual inspection of nozzle ring components for any apparent damage, failure or apparent mispositioning of vanes. Replace all affected nozzle ring components. During reassembly ensure that capscrews are properly installed with recommended pretorque.

- Monitor engine operation to ensure exhaust gas temperatures do not exceed those specified.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Turbocharger Thrust Bearing Lubrication System
UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-CFR
TASK DESCRIPTION NO. DR-12-02-CFR-0

SNPS GPL NO. 03-CFR
CLASSIFICATION TYPE C

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry and site experience in the EDG Component Tracking System.

There are no maintenance recommendations for this component. However, the lead engine report does address site specific additions of supports. The necessity for similar additions on WNP-1 is addressed below.

A field walkdown was performed at WNP-1 in accordance with the small bore piping and tubing criteria document (Ref. 1). However, a review of this component was not possible due to its uninstalled condition at the time of the walkdown. Therefore, component acceptability and any subsequent recommendations shall be based upon the lead engine DR/QR report. This component is considered essentially the same as the Comanche Peak component based on a comparison of assembly drawings from each of the TDI parts manuals (Vol. II). Reference Dwg. No. 102269.

Therefore, based on the above review, it is concluded that this component will perform its intended design function at WNP-1 under all normal operating and earthquake loadings with the provision that the following recommendations be implemented upon installation of this component.

- The maximum tubing span length should not exceed 3'-6" in order to minimize the effects of turbocharger operating vibrations.
- The first support should be as close to the sight glass as practical.
- The 1/4" tubing from the sight glass to the cross should have a lateral offset to accommodate thermal expansion.
- There should be a minimum of 6" offset around bends to accommodate thermal expansion.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. "Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Coglan PROGRAM MANAGER K.T. Fitzpatrick for JCK

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Intake Manifold & Piping (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-375

TASK DESCRIPTION NO. DR-12-02-375-0

SNPS GPL NO. 03-375

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- Industry experiences at Comanche Peak and Grand Gulf include cases of elbows cracking during installation. The maintenance recommendation presented below address this concern.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak)
- A comparison of the intake manifold and piping spool pieces, fittings and supports for WNP-1 with Comanche Peak.

The following modification recommendations made on the lead engine DR/QR report should be implemented:

- Ensure U-bolts on the crossover piping are properly installed.

The following maintenance recommendations are made to avoid cracking due to misalignment during installation:

- Other castings may be tried in an attempt at a better fit.
- Bolt hole diameter on the intake manifold elbows may be increased from 1/16-inch oversize to 1/8-inch oversize. However, under no circumstances shall any component be jacked to fit.

The following inspections from the CQRC should be performed on all station engines:

- Visually inspect all intake manifolds for cracks at both flange faces.
- Upon reinstallation, ensure that the manifold installation does not cause excessive stress on flange bolt holes due to misalignment.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Cerdogan PROGRAM MANAGER Kevin T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Exhaust Manifold

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-380A

TASK DESCRIPTION NO. DR-12-02-380A-0

SNPS GPL NO. 03-380A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak)
- A comparison of the Exhaust Manifold and piping spool pieces, fittings and supports for WNP-1 with Comanche Peak.

The diesel generators at WNP-1 have not yet been operational, therefore, no operating hours or temperatures can be projected.

The following modification recommendations made on the lead engine DR/QR report should be implemented:

1) The second 6" slip joint from the No. 8 cylinder head, on both right and left banks is to be removed and replaced with 6"-150lb. S.O. Flanges with A449 bolts.

2) The first 6" slip joint from the No. 2 cylinder head (second from the No. 7 cylinder head), on both the right and left banks, is to be removed and replaced with 6"-150lb. S.O. Flanges with A449 bolts.

3) The first 6" slip joint from the No. 3 cylinder head (second from the No. 6 cylinder head), on both the right and left banks, is to be removed and replaced with 6"-150lb. S.O. Flanges with A449 bolts.

4) The first slip joint from the No. 4 cylinder head (second from the No. 5 cylinder head), on both the right and left banks, is to be removed and replaced with 6"-150lb. S.O. Flanges with A449 bolts.

5) In the event of an SSE, the capscrews, which hold the water jacket to the exhaust manifold assembly support, will require a visual inspection at some time subsequent to the SSE event and replaced if the inspection warrants.

The following maintenance recommendation is required to be performed on the exhaust manifold:

- Perform a visual inspection and a magnetic particle test on a sample of the circumferential pipe welds and corresponding heat affected zones. This is to be performed during the first refueling outage and alternate outages thereafter. However, diesel operation should not exceed 200 hours between inspections.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Cadogan PROGRAM MANAGER Kevin T. Fitzpatrick

GI1-85-0160

CRM: (ORIG) E
ADDRESSEE
FDCC
READING FILES (3)

DUKE POWER COMPANY
GENERAL OFFICES
422 SOUTH CHURCH STREET
CHARLOTTE, N. C. 28242

P. O. BOX 33189

TELEPHONE: AREA 704

September 27, 1985

Mr. L C Oakes
Mechanical Project Engineer
Washington Public Supply System
P O Box 460
Richland, WA 99352

Re: Management and Technical Services
TDI Diesel Generator Owners Group
Washington Public Power Supply System Nuclear Project No. 1
Exhaust Manifold Piping
Supplemental Report
File: MTS-4086

Dear Mr. Oakes:

Attached please find one copy of Supplemental Report No. 1 for component 02-380A. This report excepts the requirement in the original report that four of the twelve slip joints for this component be removed and replaced by 150 lb. slip-on flanges. Also, please note that Transamerica Delaval, Inc. has reviewed this report and is in complete concurrence with its findings.

If you have any questions or require additional information, please contact S E Eckert at 704-373-3818.

Very truly yours,

A P Cobb, Jr, Manager
Project Management Division

By: A M Segrest
Senior Engineer

AMS/SEE/kfb/E9-29/2

cc: C L Ray (w/o attach)

att: GI1-85-0160

RECEIVED
OCT - 3 1985
W.P.P.S.S.

SUPPLEMENT 1

TDI OWNERS GROUP

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

NUCLEAR PROJECT NO. 1

Exhause Manifold Piping
(Large Bore Scope Only)

Component Part No. 02-380A

Performed By:

Duke Power Company
Management and Technical Services
September 27, 1985

SUPPLEMENT 1

TDI OWNERS GROUP

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

Exhaust Manifold Piping
(Large Bore Scope Only)

Component Part No. 02-380A

I. INTRODUCTION

The purpose of this supplement is to summarize the evaluation performed to justify eliminating the recommended modifications as stated in the original report.

The exhaust manifold piping contains a sliding span of pipe with a slip joint at each end. These slip joints allow movement along the pipe axis. As stated in the original calculation (Reference No. 1), in a linear elastic analysis using simplified boundary conditions, this type of component is unstable. Therefore, the original report recommended replacing one slip joint at the end of the sliding spans with a slip-on flange in order to analyze the manifold using normal linear elastic analysis methods. The present exhaust manifold was not shown to be deficient in the original analysis.

II. METHODOLOGY

The effects of dead weight loads and thermal movements on the sliding span of pipe were evaluated using conventional techniques (Reference No. 2). To account for the seismic loading, several bounding cases were evaluated. These cases were developed using the sections of pipe connecting to each end of the sliding span. Each section was analyzed with and without the weight of sliding span lumped at the end (see Figures 1 and 2).

It is expected that friction from the seals in the slip joints will provide sufficient force (approximately 142 lb.) to move the sliding span along with the adjoining pipe during a seismic event while allowing relative thermal movements. The seismic displacements and rotations at the slip joint are negligible (displacements approximately .1 inches, rotations approximately .015 radians). Even if the friction force is inadequate to keep the sliding span moving with the adjoining pipe sections, restraining devices are provided to prevent separation of exhaust piping. The gap associated with the slip joint at both normal operating and ambient temperatures is much larger than the total relative movements of the adjacent piping. Therefore, no significant impact between the sliding span and adjacent piping will occur.

III. RESULTS AND CONCLUSIONS

Based on this evaluation (Reference No. 2), the exhaust manifold piping has been found to be acceptable without modification. All stress levels remain well below code allowables (maximum stress ratio of approximately 0.4). Nozzle loads are not significantly increased from those approved in the original calculation. Relative movements at the slip joints are very small and the restraining devices are adequate to prevent any lock up or separation of the exhaust piping.

The exhaust manifold piping as designed and installed by Transamerica Delaval, Inc. is adequate to perform its intended design function.

FIGURE 1
EXHAUST MANIFOLD PIPING

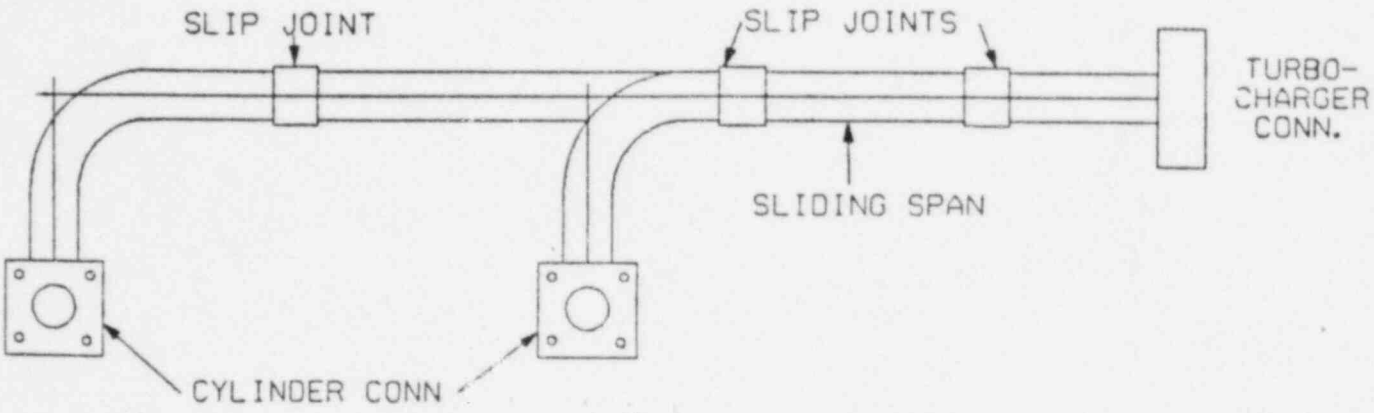
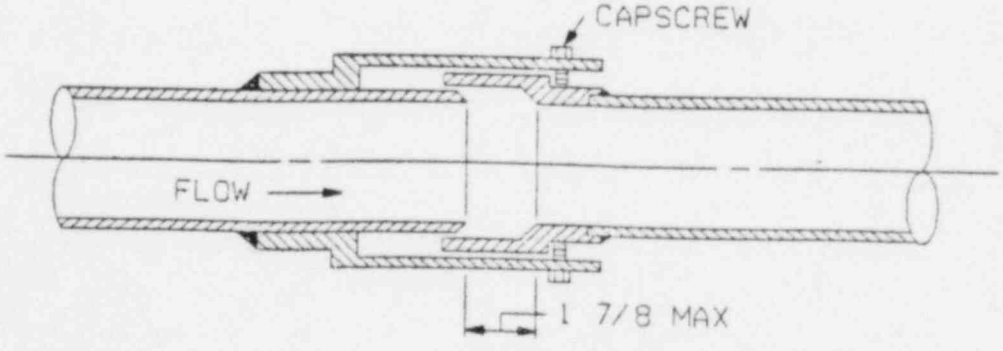


FIGURE 2
SLIP JOINT CONFIGURATION



IV. REFERENCES

1. "Supporting Calculations for the Evaluation of Comanche Peak Diesel Generator Large Diameter Piping and Supports," Impell Report No. 02-0630-1230, Rev. 0, August, 1984. Calculation No. CP-EM-001.

2. "Qualification of the Diesel Generator Exhaust Manifold Assembly," Duke Power Company, Calculation No. CNC-1206.02-50-0001, Rev. 0.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Exhaust Manifold: Gasket & Bolting

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-380B

TASK DESCRIPTION NO. DR-12-02-380B-0

SNPS GPL NO. 03-380B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry experience. There is no site experience reported in the EDG Component Tracking System.

There are no maintenance or modification recommendations for this component.

The following Quality inspections should be performed on all station engines:

- Verify that the proper torque was applied to the exhaust pipe flange capscrews;
- Verify that the proper gasket material and bolting are installed at the manifold and flange connections;
- Verify at reinstallation that no binding exists on the exhaust manifold and no cracks exist at the manifold flange fillets by a visual inspection.
- Perform a dimensional check of the capscrews.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

COMPONENT DESIGN REVIEW CHECKLIST

DR-12-02-380B-0

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John Cadogan PROGRAM MANAGER K T Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Intercooler Piping - Pipe (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-436A&B

TASK DESCRIPTION NO. DR-12-02-436A&B-0

SNPS GPL NO. 99-436A&B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak)
- A comparison of the intercooler piping spool pieces and fittings for WNP-1 with Comanche Peak.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Conlon PROGRAM MANAGER Kevin T. Fitzpatrick

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Intercooler Piping Coupling,
Gaskets, Bolting

COMPONENT PART NO.: 02-436B

See Component Part No.: 02-436A

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Turbo Water Piping-Pipe and Fittings (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-437

TASK DESCRIPTION NO. DR-12-02-437-0

SNPS GPL NO. 03-437A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry experience. There is no site experience for this component in the EDG Component Tracking System.

There are no modification recommendations for this component.

As a maintenance recommendation, in the event of a leak developing in the existing Dresser Style 65 couplings, these couplings should be replaced with Dresser Style 90 couplings with Viton gaskets. This recommendation is made on the basis that the maximum suggested operating temperature of 150° F for the Style 65 coupling may be exceeded. The maximum suggested operating temperature of the Style 90 is 212° F.

A field walkdown was performed in accordance with the small bore piping criteria document (Ref. 1) and concluded that this component will perform its intended function for normal and earthquake loadings.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Conley PROGRAM MANAGER Kevin T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Turbocharger-Bracket: Bolting and Gaskets

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-475A&C

TASK DESCRIPTION NO. DR-12-02-475A&C-2

SNPS GPL NO. 03-475A&D

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for these components is not required based on a review of the following:

- The Comanche Peak lead engine DR/QR report (Ref. 1).
- TDI Parts Manuals, Volume II for WNP-1 and Comanche Peak Power Stations (Refs. 2 and 3).
- TDI drawings (Ref. 4).
- The EDG Component Tracking System for applicable industry and site experience (Refs. 5 and 6). Nuclear and non-nuclear experience identifies a few incidents of broken welds on fabricated items or piping supported by the turbocharger bracket; such events were caused by loosened or broken turbocharger hold-down bolts, all resulting from engine vibration. To prevent recurrence of similar events, verification of the torque values applied to the turbocharger hold-down bolts and the bracket mounting bolts during installation is required.

The Comanche Peak lead engine DR/QR report indicates that the pipe thermal loads, along with the engine vibration loads, are the most significant loads experienced by the brackets and the mounting bolts. The design of the water jacketed, multi-pipe, exhaust manifold connecting the cylinders to each turbocharger is identical for both stations. The adapter piece at the compressor outlet connection and its intake manifold is also similar. The thermal loads experienced by the turbocharger brackets and the associated mounting hardware for both stations should therefore remain similar.

Review of the amplified response acceleration spectra curves for WNP-1 Station (Ref. 7) indicates that the seismic loadings are more favorable than those at the Comanche Peak Station.

TASK DESCRIPTIONS (continued)

Based on the above review the turbocharger brackets at WNP-1 should be adequate to resist the seismic inertia loads, deadweight, thermal loads, and engine vibration loads. Similarly, the 3/4 in. capscrews (12 screws for each bracket) attaching the bracket to the engine block should be satisfactory; however, based on the DR/QR report for Comanche Peak Station, the review of the turbochager and bolting finds that in the worst case load condition, vibration and manifold nozzle loads could potentially produce bolt loads in excess of preloads. Therefore the bracket to engine and bracket to turbo base screws (P.N. GB-001-143 and GB-001-120) are recommended to be inspected on a regular basis as discussed below:

- Each month for the first three months of commercial operation these screws should be inspected to assure that no screw has loosened due to engine operating loads. If during these inspections none of the screws are found loosened or damaged, from then on inspections are to be conducted on a yearly basis (or during plant shutdown). But if at any time during inspection any screw is found loosened or damaged, it must then be replaced (if damaged) and all screws retorqued as follows; 125 ft-lbs for the bracket to engine screws and 75 ft-lbs for the bracket to turbo base screws.

To avoid damage to bracket to engine, and/or bracket to turbo, base screws, the proper torques as delineated above should be utilized for each respective bracket bolting application.

There are no maintenance recommendations for these components.

The following inspections as described in the Component Quality Revalidation Checklist for Component No. 02-475C should be performed on both engines:

- Verification of compliance to the TDI Instruction Manual for bolt torque loads applied to the bolted connections through review of existing documentation.

- Visual inspection to verify proper installation of the bracket bolting.

- Verification of the material of the bracket-to-engine bolting.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. Comanche Peak Steam Electric Station - Unit 1, DR/QR Report for Group Parts List No. 02-475A&C.

2. TDI Manual Volume II, for Model DSRV-16-4 Diesel Engine/Generator, WPPSS Nuclear Power Plant, Units 1 and 4, Parts List No. 02-475-22-02, Rev. 3, dated October 22, 1979, and Drawing 02-475-22, Rev. B, dated February 9, 1978.

3. TDI Manual Volume II for Model DSRV-16-4 Diesel Engine/Generator, Comanche Peak Steam Electric Station - Unit 1, Parts List No. 02-475-22-02, Rev. C.

4. TDI Drawings

Drawing No.	Description
02-475-22-AL	Bar Support Outer
02-475-22-AK	Bar Support Inner
02-475-21-AD	Adapter, Intercooler Inlet - Right Bank
02-475-21-AE	Adapter, Intercooler Inlet - Left Bank
02-475-21-AF	Bracket, Turbo G-90 - Right Bank
02-475-21-AG	Bracket, Turbo G-90 - Left Bank
02-475-22-AA	Adapter, Intercooler Outlet - Right Bank
02-475-22-AB	Adapter, Intercooler Outlet - Left Bank

5. Emergency Diesel Generator Component Tracking System - Nuclear and Non-nuclear Industry Experience dated November 5, 1984.

6. Emergency Diesel Generator Component Tracking System - WPPSS Nuclear Power Station dated December 7, 1984.

7. Specification 9779-53, Rev. 6, 1/27/77 "Diesel Generators" for the WPPSS Nuclear Project Nos. 1 and 4".

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cudlog PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Turbocharger-Bracket: Air Butterfly Valve Assembly

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-475B

TASK DESCRIPTION NO. DR-12-02-475B-0

SNPS GPL NO. 03-475B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that which was previously addressed in the lead engine DR/QR report. There was no site experience listed in the Component Tracking System.
- A review of the lead engine DR/QR report (Shoreham).
- Similarity between WNP-1 and lead engine components.

The following maintenance recommendation from the lead engine DR/QR report should be implemented:

- Locking devices on the valve linkages should be verified to be snug on a monthly basis.

The following modification has been made, per TDI DWG #03-475-6491:

- Addition of grease fittings per TDI SIM 322.

No other modifications are required for this component, based on the lead engine report.

The following Quality inspections have not been performed to date and are recommended:

- Perform a inspection of the butterfly to shaft attachment pins for signs of distress. Document with photographs.
- Perform a visual inspection of the shaft for signs of lubrication, wear, and distress. Document with photographs.

TASK DESCRIPTIONS (continued)

- Verify the butterfly valve is properly installed.
- Perform a micohardness test on the shaft (TDI P/N 02-475-15AS).

Note: Perform inspections on Engine A. If results are unsatisfactory, perform identical inspections on Engine B.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John Cooley PROGRAM MANAGER J.C. Kamminga

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Turbocharger: Bracket -
Bolting & Gaskets

COMPONENT PART NO.: 02-475C

See Component Part No.: 02-475A

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Intake Air Silencer UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-717P REV. NO. 1

SNPS GPL NO. 99-805

TASK DESCRIPTIONS

No further review of component 02-717P is required for the following reasons:

a) There is no site or industry experience in evidence.
b) The Intake Air Silencer was manufactured by American Air Filter, a subsidiary of Allis Chalmers. Their products including the Intake Air Silencer are widely used in the nuclear and non-nuclear industry. Their products are designed to AFI standards. A review of their air filters was performed at Shoreham with satisfactory results.

GROUP CHAIRPERSON Victor A Zaleta PROGRAM MANAGER [illegible]

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Intake Air Filters

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 84-111

TASK DESCRIPTION NO. DR-12-84-111-0

SNPS GPL NO. 10-114

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience. There was no site experience listed in the Component Tracking System.
- A review of the lead engine DR/QR reports (Shoreham and Comanche Peak).
- Air filters for lead reports and WNP-1 are supplied by American Air Filter and are of similar design. The inlet site at WNP-1 is 28" versus 24" for Comanche Peak.

The following maintenance recommendation from the lead engine DR/QR report should be implemented:

- Filter cartridges should be inspected and/or replaced at 3 to 6 month intervals.

There are no modifications recommended for this component, based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Codega PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Intake Air Filters

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 84-111

TASK DESCRIPTION NO. DR-12-84-111-0

SNPS GPL NO. 10-114

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience. There was no site experience listed in the Component Tracking System.
- A review of the lead engine DR/QR reports (Shoreham and Comanche Peak).
- Air filters for lead reports and WNP-1 are supplied by American Air Filter and are of similar design. The inlet site at WNP-1 is 28" versus 24" for Comanche Peak.

The following maintenance recommendation from the lead engine DR/QR report should be implemented:

- Filter cartridges should be inspected and/or replaced at 3 to 6 month intervals.

There are no modifications recommended for this component, based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Codega PROGRAM MANAGER JC Hammerer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Flex Connections

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 84-114

TASK DESCRIPTION NO. DR-12-84-114-0

SNPS GPL NO. 10-109

CLASSIFICATION TYPE C

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak).

The exhaust flex connection resides downstream of the turbocharger. A failure of the exhaust flex connection would result in exhaust gases penetrating the boundary and escaping into the diesel room. This would not impair the diesel operability and is, therefore, deemed acceptable.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Cadogan PROGRAM MANAGER JC Kammingga

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil Full Pressure Strainer

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. SE-025

TASK DESCRIPTION NO: DR-12-SE-025-0

SNPS GPL NO. 04-000

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that which was previously addressed in the lead reports. There was no site experience listed in the Compoment Tracking System.
- A review of the lead engine DR/QR report (Comanche Peak).
- Similarity of WNP-1 and lead engine components. Both plants use Air Maze simplex strainers with 100% filtration at 80 micron.

The following maintenance recommendation from the lead engine DR/QR report should be implemented:

- The differential pressure should be checked during each engine operation and the strainer element should be cleaned/replaced at 15 psid, per TDI Manual, or at any significant increase in ΔP.

There are no modifications required for this component, based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

ACCEPTANCE CRITERIA

Not required

REFERENCES

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil Pressure Regulating Valve

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 00-420

TASK DESCRIPTION NO. DR-12-00-420-0

SNPS GPL NO. 00-420

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no industry or site experience.
- A review of the lead engine DR/QR report (Comanche Peak)
- Lube oil regulator valves at Comanche Peak and WNP-1 are identical. (TDI Part No. 00-420-01-0C).

The following maintenance recommendations from the lead engine DR/QR report should be implemented:

- Disassemble and clean valve at each refueling outage.
- If valve plugging becomes a problem, measure the dimensions of the valve internals for proper clearance an increase frequency of valve cleaning.

There are no modifications for this component, based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Conboy PROGRAM MANAGER Lynn Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil Fittings Internal Headers (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-307A

TASK DESCRIPTION NO. DR-12-02-307A-0

SNPS GPL NO. 03-307A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak)
- A comparison of the lube oil fittings - internal headers and piping spool pieces and fittings for WNP with Comanche Peak.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil Fittings-Internal: Headers (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-307A

TASK DESCRIPTION NO. DR-12-02-307A-0

SNPS GPL NO. 03-307A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry experience. There is no site experience for this component in the EDG Component Tracking System.

There are no maintenance recommendations for this component. However, the lead engine report does address site specific modifications to supports. The necessity for similar modifications on WNP-1 is addressed below.

A field walkdown was not possible due to component inaccessibility. However, this component will perform its intended function for all normal and earthquake loadings provided the supports are verified as indicated in 02-307D. It is to be noted that the verification recommendations are based on the review of the DR/QR report for Comanche Peak.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTES TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John F Caylor PROGRAM MANAGER K.J. Fitzpatrick for JCR

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil Fittings-Internal-Tubing and Fittings (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-307B

TASK DESCRIPTION NO DR-12-02-307B-0

SNPS GPL NO. 03-307B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry experience. There is no site experience for this component in the EDG Component Tracking System.

There are no maintenance recommendations or support modifications for this component.

A field walkdown was not performed due to component inaccessibility. However, it should be noted that due to spatial restrictions, all sections of unsupported tubing will meet acceptable span lengths. Therefore this component will perform its intended function for all normal and earthquake loading.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTES TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature] for JCK

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil Fittings Internal - Supports (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-307D

TASK DESCRIPTION NO. DR-12-02-307D-0

SNPS GPL NO. 03-307D

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR Reports (Comanche Peak and Grand Gulf). There is no site or industry experience for this component in the EDG Component Tracking System.

There are no maintenance recommendations for this component. The lead engine reports do address the following recommended modifications to supports:

- Replace all 1/4-inch U-bolts with 3/8-inch U-bolts.
- The U-bolts should be torqued sufficiently to prevent the header from moving axially without overstressing the header. Nuts should have suitable locking devices installed.
- The U-bolt radius should be coincident with the radius of the header to provide a snug fit.

A field walkdown was not possible due to component inaccessibility. However, this component will perform its intended function for normal and earthquake loading provided that the 3/8-inch U-bolts are verified to be installed as per the TDI parts manual (Vol. II) and the other aformentioned lead engine recommendations are verified to be implemented.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON J. J. Corlogan PROGRAM MANAGER K.T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Engine Driven Lube Oil Pump

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-420

TASK DESCRIPTION NO. DR-12-02-420-0

SNPS GPL NO. 03-420

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that previously addressed in the lead engine report. There was no site experience listed in the Component Tracking System.
- A review of the lead engine DR/QR report for Comanche Peak.
- Similarity of the WNP-1 component to the lead engine component. Both are IMO Model 3JK-437D.

There are no maintenance recommendations for this component as a result of the lead engine design review.

It is recommended that a Style 90 or 165 Dresser coupling with Viton gaskets be added on the pump suction line to mitigate the thermal expansion loading and stresses on the pump inlet nozzle. The coupling should be located between the relief valve branch connection and the pump inlet nozzle.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON PROGRAM MANAGER

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil Lines - External Tubing, Fittings, Couplings (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-465A

TASK DESCRIPTION NO. DR-12-02-465A-0

SNPS GPL NO. 03-465A

CLASSIFICATION TYPE ____ A

TASK DESCRIPTIONS

Design review for the installed portion of the subject component is not required based on the following: (The scope of the subject evaluation includes the piping components from the lube oil strainers to the internal headers, from the 3-way valve connection to the lube oil strainers and from the engine drain to the sump tank).

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak)
- A comparison of the above stated portion of the lube oil lines - external piping spool pieces and fittings for WNP-1 with Comanche Peak.

A review of the partially installed portion of the piping spool pieces and fittings (the pressure regulatory system between the L.O. pump and the L.O. cooler) is not required based on the following:

- This portion is to be installed per TDI Parts Manual for WNP-1.

The following maintenance recommendations should be implemented:

- The 12-inch Dresser coupling gasket is to be replaced with Viton gasket should leaks develop.
- Ensure a minimum installation gap of 0.171 inches, between pipe ends, exists at the 12-inch Dresser coupling.

Note that these items are to be incorporated upon installation.

There were no modification recommendations made on the lead engine DR/QR report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John Cardog PROGRAM MANAGER Kevin T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT NO. 1

COMPONENT Lube Oil Lines-External-Tubing, Fittings, Coupling (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PART LIST NO. 02-465A

TASK DESCRIPTION NO: DR-12-02-465A-0

SNPS GPL NO. 03-465A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

A design review for this component is not required based on the review of the lead engine DR/QR reports (Comanche Peak, Grand Gulf and Catawba) and the applicable industry and site experience listed in the EDG Component Tracking System.

A field walkdown was performed at WNP-1 in accordance with the small bore piping criteria document (Ref. 1). However, a review of this component in its entirety was not possible since portions of piping and tubing were not installed at the time of the walkdown. Therefore, component acceptability and any subsequent recommendations shall be based upon the lead engine DR/QR reports (Comanche Peak, Grand Gulf and Catawba).

The lead engine DR/QR reports address the need for site specific support additions and modifications. The necessity for similar additions/modifications for WNP-1 is addressed in DR/QR report 02-465B. Therefore, based on the above review, it is concluded that this component will perform its intended function at WNP-1 under all normal operating and earthquake loadings provided that supports are added/modified as indicated in DR/QR report 02-465B.

There are no maintenance recommendations for this component.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John Conley PROGRAM MANAGER Kevin T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil Liner - External Supports (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-465B

TASK DESCRIPTION NO. DR-12-02-465B-0

SNPS GPL NO. 03-465B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

There are no supports for this component at WNP-1.

No design review required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER J C Kammerer

WN3618/1

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

LUBE OIL LINES EXTERNAL: SUPPORTS
(SMALL BORE SCOPE ONLY)
COMPONENT PART NO. 02-465B

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the structural adequacy of the lube oil external supports to withstand the effects of normal operating and earthquake loadings. The primary function of these supports is to provide adequate restraint to the external lube oil small bore piping/tubing.

II OBJECTIVE

The objective of this review was to perform an engineering evaluation of the small bore piping/tubing supports to assure that the component will perform its intended design function during normal operating and earthquake loadings.

III METHODOLOGY

In order to meet the stated objective, the following methods were used:

- The TDI Emergency Diesel Generator Component Tracking System was reviewed for the WNP-1 site, nuclear and non-nuclear industry experience. See Appendix C for results.
- The Quality Revalidation Checklist results were reviewed for acceptability.
- Both engines were partially assembled at the time of site inspection. This component was evaluated using actual walkdown information and by comparison to the Comanche Peak lead engine report.

Refer to the review procedures as described in Reference 1 for a detailed methodology of this evaluation.

IV RESULTS AND CONCLUSIONS

The supports, as defined by this Component Design Review, have been evaluated in accordance with Reference 1 and have been found acceptable with modifications.

There are no Quality Revalidation Checklist results or TERs associated with this component.

Based on the above review and information contained in Reference 2, it is concluded that the supports will perform their intended design function at WNP-1 under all normal operating and earthquake loadings with the provision that the following recommended modifications be implemented as detailed in Reference 3:

Engines A and B

Lube Oil Headers

- One of the eight required two-directional restraints on each engine bank should be revised to a three-directional restraint and located approximately mid-engine. The remaining two-directional restraints should be modified or shimmed as required to provide proper sliding fit.

In order to support the tubing of component 02-465A, it is recommended that the following supports be added:

Engine A and B

Lube Oil Gear Case Header And Branches

- A two-directional restraint should be added in the riser of the 1¼ I.P.S. gearcase header near the top to provide lateral support of the cantilevered configuration.

Lube Oil Supply from the Filters to the Crossover Header

- A three-directional restraint should be added to the 1½ I.P.S. riser to the crossover header from the turbocharger support bracket as shown on TDI Drawing 02-465-21 (Items 48 and 79).

Governor Lube Oil from Governor Lube Oil Cooler

- A cover plate attached to the structure should be added to the existing spacer attached to the three lube oil tubes below the governor.

- A two-directional lateral restraint should be added to each of the three lube oil tubes at the risers below the right turbocharger support bracket.

Engine B

Lube Oil Gear Case Header And Branches

- A two-directional restraint should be added in the 3/8-inch tubing horizontal run to the left bank camshaft bearing at approximately mid-span, similar to Engine A.

Governor End Crossover Header

- A three-directional restraint should be added adjacent to the tee connection as shown on TDI Drawing 02-465-21 (Item 48) similar to the Engine A installation.

V REFERENCES

1. "Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 0.

2. Stone & Webster Calculation number 11600.60-NP(B)-1201-XH

3. Memo No. 6596 from C. Malovrh/SWEC to J. Kammeyer/SWEC dated 12/21/84.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil Lines External: Supports (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

COMPONENT PART NUMBER 02-465B

TASK DESCRIPTION NO.: DR-12-02-465B-0

(SNPS GPL NO. 03-465B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Perform an engineering review of the small bore piping/tubing supports to provide additional assurances that the component will perform its intended design function during normal operating and earthquake loading.

PRIMARY FUNCTION

Provide adequate restraint of the small bore piping/tubing system, in the intended support load direction.

ATTRIBUTE TO BE VERIFIED

Structural adequacy of the small bore pipe/tube supports due to the effects of normal operating and earthquake loadings.

SPECIFIED STANDARDS

IEEE 387; ANSI B31.1,"Power Piping"

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1

DOCUMENTATION REQUIRED

Delaval design documentation (specifications, calculations, drawings, etc.). In lieu of information from Delaval, the following information is required: verified support sketches and piping isometrics, material specifications, pipe size and schedule, and operating parameters (pressure, temperature, load combinations)

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Lube Oil Lines - External: Supports

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-465B

REV. NO. 2

SNPS GPL NO. 02-465B

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

2. Obtain sufficient data to support the design review effort. This may be accomplished by developing quality verified as-builts in accordance with Procedure DG-7, or by the Design Group performing a field walkdown.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

2. Information necessary for the design review effort

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package

2. Review of detailed information by the Design Group

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52
2. Procedure DG-7

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet
2. Quality verified as-built isometric drawings for the supports if if available from the Owner.

Engine B

Same as Engine A

GROUP CHAIRPERSON Steven M. Schmidt PROGRAM MANAGER K.T. Fitzpatrick

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COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.
2. The Design Group will be responsible for closing out this item. This can be done per Procedure DG-7 or by the performance of an engineering walkdown by the Design Group.

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON Keith A. Salcott PROGRAM MANAGER K.T. Fitzpatrick

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-465B

Effective Printout Date: 11/30/84

COMPONENT TYPE: Lube Oil Lines External: Supports

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
None		
NON-NUCLEAR		
None		

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil Lines External - Valves

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-465C

TASK DESCRIPTION NO. DR-12-02-465C-0

SNPS GPL NO. 99-465A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no industry or site experience.
- A review of the lead engine DR/QR report (Comanche Peak)
- Similarity of WNP-1 and lead engine component.
- The Clow, Williams-Hager check valves (2, 2½ and 6 in.) as well as the Tufline 3-way valve are used at both Perry and Comanche Peak. The Whitey ¼" shutoff valve was used at Comanche Peak in other systems (i.e., jacket water) and there is no adverse experience with this valve.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cudoga PROGRAM MANAGER JC Kammerer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Turbocharger - Lube Oil Fitting Piping (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-467A

TASK DESCRIPTION NO. DR-12-02-467A-0

SNPS GPL NO. 03-467A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for the installed portion of the subject component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak)
- A comparison of the turbocharger - lube oil fittings piping spool pieces and fittings for WNP-1 with Comanche Peak.
- The items listed in the below referenced letter are incorporated.

A review of the partially installed portion of the piping spool pieces and fittings is not required based on the following:

- This portion is to be installed per TDI Parts Manual for WNP-1.

The following modification recommendation made on the lead engine DR/QR report should be implemented:

- The 2½-inch Dresser couplings (located between the turbocharger and L.O. sump tank for both drain lines) are to be removed and replaced with 2½-inch 150lb. S.O. Flanges with A307 bolts.

There are no maintenance recommendations applicable to this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

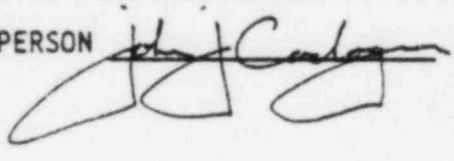
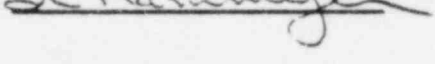
Not required

REFERENCES

Letter 0630-037-NY-150, Recommended Design of Piping Components 02-467A and 02-467B for WNP-1, R. Markovich/G.Shears, Impell Corporation to J.C. Kammeyer, Duke Power, dated 12/20/84

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Conlon PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Turbocharger-Lube Oil Fitting-Pipe, Tubing, Fittings and Flexible Coupling (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-467A

TASK DESCRIPTION NO. DR-12-02-467A-0

SNPS GPL NO. 03-467A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry experience. There is no site experience for this component in the EDG Component Tracking System.

There are no maintenance recommendations for this component. However, the lead engine report does address site specific additions of supports. The necessity for similar additions on WNP-1 has been assessed by a field walkdown.

The field walkdown was performed in accordance with the small bore piping criteria document (Ref. 1) and concluded that this component will perform its intended function for normal and earthquake loading provided that the supports are added/modified as indicated in DR/QR report 02-467B.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. "Engineering Review ..it via Document for the Design Review of TDI Diesel Small Bore Piping, ..ping, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Cudzyo — PROGRAM MANAGER K. T. Fitzpatrick for TEX

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Turbocharger - Lube Oil Fitting: Supports (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-467B

TASK DESCRIPTION NO. DR-12-02-467B-0

SNPS GPL NO. 03-467B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak)
- A comparison of the turbocharger - lube oil fittings supports for WNP-1 with Comanche Peak.
- The items listed in the below referenced letter are incorporated.

The following modification recommendation made on the lead engine DR/QR report should be implemented:

- The multiple support (attached to both 2½-inch drain lines) located between the lube oil sump tank and Dresser coupling require reinforcement of its support members and increases in their welds.

There are no maintenance recommendations applicable to this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

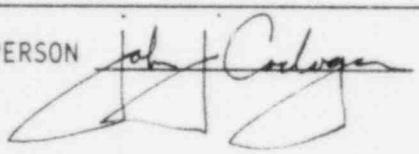
Not required

REFERENCES

Letter from R. Markovich/G. Shears (Impell) to J. Kammeyer (SWEC), "Recommended Design of Piping Components 02-467A&B for WNP," dated 12/20/84.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

TURBOCHARGER - LUBE OIL FITTINGS: SUPPORTS
(SMALL BORE SCOPE ONLY)
COMPONENT PART NO. 02-467B

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the structural adequacy of the turbocharger lube oil piping/tubing supports to withstand the effects of normal operating and earthquake loadings. The primary function of these supports is to provide adequate restraint of the piping/tubing system in the intended support load direction.

II OBJECTIVE

The objective of this review was to perform an engineering evaluation of the piping/tubing supports to assure that the component will perform its intended design function during normal operating and earthquake loadings.

III METHODOLOGY

In order to meet the stated objective, the following methods were used:

- The TDI Emergency Diesel Generator Component Tracking System was reviewed for the WNP-1 site, nuclear, and non-nuclear industry experience. See Appendix C for results.

- The Quality Revalidation Checklist results were reviewed for acceptability.

Refer to the review procedures as described in Reference 1 for a detailed methodology of this evaluation.

IV RESULTS AND CONCLUSIONS

The piping/tubing supports, as defined by this Component Design Review, have been evaluated in accordance with Reference 1 and have been found acceptable with modifications.

There are no Quality Revalidation Checklist results or TERs associated with this component.

Based on the above review and information contained in Reference 2, it is concluded that the piping/tubing supports will perform their intended design function at WNP-1 under all normal operating and earthquake loadings with the provision that the following recommended modifications are implemented as detailed in Reference 3:

Engines A, Right Bank Turbocharger

The 3 x ¼-inch plate restraint located below the cross on the 3/4-inch tube should be stiffened to increase its ability to accept lateral tubing loads. Note: Existing installation is not complete as tube block is not attached to supporting structure.

Engines B, Right Bank Turbocharger

The 1½ x ¼ inch bent plate restraint located on the 45 degree offset below the cross on the 3/4-inch tube should be stiffened to increase its ability to accept lateral tubing loads.

Engines A and B

In order to support the tubing of component 02-467A, it is recommended that the following supports be added:

Right Bank Turbocharger

A two-directional restraint should be added on the 3/4-inch tube at approximately mid-span between the lube oil header and the first restraint.

Left Bank Turbocharger

A two-directional restraint should be added on the 3/4-inch tube in the riser between the turbocharger inlet and the first restraint at a location similar to the right bank turbocharger.

V REFERENCES

1. "Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 0.

2. Stone & Webster Calculation number 11600.60-NP(B)-1201-XH

3. Memo No. 6596 from C. Malovrh/SWEC to J. Kammeyer/SWEC dated 12/21/84.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Turbocharger - Lube Oil Fittings: Supports (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-467B

TASK DESCRIPTION NO. DR-12-02-467B-0

SNPS GPL NO. 03-467B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Perform an engineering review of the small bore piping and tubing supports to provide additional assurances that the component will perform its intended design function during normal operating and earthquake loading.

PRIMARY FUNCTION

Provide adequate restraint of the small bore piping/tubing system, in the intended support load directions.

ATTRIBUTE TO BE VERIFIED

Structural adequacy of the small bore piping and tubing supports due to the effects of normal operating and earthquake loadings.

SPECIFIED STANDARDS

IEEE-387 ; ANSI B31.1,"Power Piping"

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Delaval design documentation (specifications, calculations, drawings, etc.). In lieu of information from Delaval, the following information is required: verified support sketches and piping isometrics, material specifications, pipe size and schedule, and operating parameters (pressure, temperature, load combinations)

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Turbocharger-Lube Oil Fittings: Supports

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-467B

REV. NO. 2

SNPS GPL NO. 03-467B

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

2. Obtain sufficient data to support the design review effort. This may be accomplished by developing quality verified as-builts in accordance with Procedure DG-7, or by the Design Group performing a field walkdown.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

2. Information necessary for the design review effort

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package

2. Review of detailed information by the Design Group

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52
2. Procedure DG-7

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet
2. Quality verified as-built isometric drawings for the supports if available from the Owner.

Engine B

Same as Engine A

GROUP CHAIRPERSON Steve N Schwartz PROGRAM MANAGER K T Fitzpatrick

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COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.
2. The Design Group will be responsible for closing out this item. This can be done per Procedure DG-7 or by the performance of an engineering walkdown by the Design Group.

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-467B

Effective Printout Date: 11/30/84

COMPONENT TYPE: Turbocharger - Lube Oil Fittings: Supports

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
None		
NON-NUCLEAR		
None		

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil Sump Tank and Mounting Hardware

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-540A&C

TASK DESCRIPTION NO. DR-12-02-540A&C-0

SNPS GPL NO. 03-540A&C

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component for WNP-1 is not required based on following:

- A review of applicable industry experience from the EDG Component Tracking System indicated that no significant experience items have been reported. No site experience items have been reported at WNP-1 from the Component Tracking System.
- The sump tank and its mounting at WNP-1 is very similar to that at Comanche Peak, which was previously reviewed and found acceptable. Some tank components are identical. The tanks are very similar even though the WNP-1 tank is noncode and the Comanche Peak tank is ASME III.
- A detailed analysis was performed to seismically qualify the sump tank, Ref. 3.

There are no maintenance or modification recommendations for these components.

Use of the proper bolt torque should be verified per the CQRC for component 02-540C.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. TDI Drawings Nos. 02-540-7000 (WPPSS), 02-540-6260 (Comanche Peak).

2. Specification 9779-53, Rev 6, 1/27/77 "Diesel Generators" for the WPPSS Nuclear Project Nos. 1 and 4.

3. Seismic Qualification Report on Washington Public Power Supply System Nuclear Projects Nos. 1 and 4 Prepared by Structural Dynamics Research Corporation for Delaval Turbine Inc., Project Number 3815, Section III.9 Lube Oil Sump Tank.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John Cadogan PROGRAM MANAGER Kevin T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil Sump Tank-Misc. Fittings, Gaskets, Pipe and Bolting Material, Valve (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-540B

TASK DESCRIPTION NO. DR-12-02-540B-0

SNPS GPL NO. 03-540B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak). There is no site or industry experience for this component in the EDG Component Tracking System.

There are no maintenance or modification recommendations for this component.

A field walkdown was performed in accordance with the small bore piping criteria document (Ref. 1) and concluded that this component will perform its intended function for normal and earthquake loadings.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTES TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Conley PROGRAM MANAGER K.T. Fitzpatrick for JCK

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Lube Oil Sump Tank:
Mounting Hardware

COMPONENT PART NO.: 02-540C

See Component Part No.: 02-540A

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Aux. Sub base & Oil & Water Piping-Lube Oil: Pipe and Fittings

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717F

TASK DESCRIPTION NO. DR-12-02-717F-0

SNPS GPL NO. 03-717H

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry and site experience listed in the EDG Component Tracking System.

As a maintenance recommendation, in the event of a leak developing in the existing Dresser Style 65 coupling, the coupling should be replaced with a Dresser Style 90 coupling with Viton gaskets. This recommendation is made on the basis that the maximum suggested operating temperature of 150° F for the Style 65 coupling may be exceeded. The maximum suggested operating temperature of the Style 90 with Viton gaskets is 400° F.

The lead engine report does address site specific additions of supports. The necessity for similar additions on WNP-1 has been assessed by a field walkdown.

A field walkdown was performed in accordance with the small bore piping criteria document (Ref. 1) and concluded that this component will perform its intended function for normal and earthquake loading provided that the supports are added/modified as indicated in DR/QR Report 02-717I.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTES TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON PROGRAM MANAGER

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Auxiliary Sub-Base & Oil & Water Piping-Lube Oil: Valves

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717G

TASK DESCRIPTION NO. DR-12-02-717G-0

SNPS GPL NO. 03-717I

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience. Site experience from the Component Tracking System involved valves received without documentation.

- A review of the lead engine DR/QR report (Comanche Peak).

The lube oil valves at WNP-1 are very similar to those in the lead engine lube oil system. Both engines have the following valves:

Powell Globe Valves - Figure 2475 (1" and 2")
Crosby Relief Valves - Style JO-25 (2" inlet)
Crosby Relief Valves - Style JMB (1½" inlet)
Turfline Valves: 3-way - Figure 037 (2½")
Turfline Valves: 2-way - Figure 067EG (4")

WNP-1 also has an additional ¼" shutoff valve, Whitey Research Tool Co., Model SS-1VM4-54. There has been no adverse industry experience with this valve and it has been used in other applications in nuclear plant diesels.

The following maintenance from the lead engine DR/QR report should be implemented:

- Check the relief valve lift pressure every 5 years.

Proper orientation of the relief valves should be verified by field inspection (i.e., vertical installation). Pending satisfactory completion of this inspection there are no modifications required for this component based on the lead engine DR/QR report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Conlon PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Auxiliary Sub-Base & Oil and Water Piping Lube Oil-Gaskets & Bolting

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717H

TASK DESCRIPTION NO. DR-12-02-717H-0

SNPS GPL NO. 03-717J

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of applicable industry experience from the EDG Component Tracking System and the lead engine DR/QR reports (Shoreham/Comanche Peak). There is no site experience for this component in the Component Tracking System.

There are no maintenance or modification recommendations for this component.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER K.T. Fitzpatrick 8/7

WN3530/1

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Auxiliary Sub-Base & Oil & Water Piping-Lube Oil: Supports & Mounting Hardware (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717I

TASK DESCRIPTION NO. DR-12-02-717I-0

SNPS GPL NO. 03-717K

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on a review of the applicable industry experience in the CDS Component Tracking System and the lead engine DR/QR report (Comanche Peak). There is no site experience listed in the Component Tracking System.

There are no maintenance recommendations for this component. However, the lead engine report does address site specific modifications to the skid piping and/or supports. Generic application of these modifications is not required for WNP-1 since the Comanche Peak modifications were made in order for the subject piping to meet the intent and philosophy of the ASME Code for the boundary conditions and assumptions used in the Owners Group analysis. These boundary conditions and assumptions may be somewhat different from those used in the manufacturer's analysis. Lead engine skid mounted large bore pipe modifications, as they apply to equipment nozzle loads, are addressed, if necessary, in the individual equipment design reviews.

Note that portions of the subject component are not installed. In order to validate the connecting on-engine component, (02-465), the uninstalled portions of the skid piping are to be installed per TDI Detail No. 101-421.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

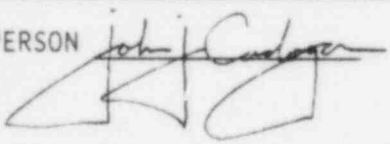
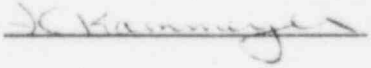
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT NO. 1

AUXILIARY SUB-BASE AND OIL AND WATER PIPING LUBE OIL:
SUPPORTS AND MOUNTING HARDWARE
(SMALL BORE SCOPE ONLY)
COMPONENT PART NO. 02-717I

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the structural adequacy of the auxiliary sub-base and oil and water piping lube oil supports and mounting hardware to withstand the effects of normal operating and earthquake loadings. The primary function of these supports is to provide adequate restraint of the small bore piping/tubing system in the intended support load direction.

II OBJECTIVE

The objective of this review was to perform an engineering evaluation of the small bore piping/tubing supports to assure that the component will perform its intended design function during normal operating and earthquake loadings.

III METHODOLOGY

In order to meet the stated objective, the following methods were used:

- The TDI Emergency Diesel Generator Component Tracking System was reviewed for the WNP-1 site, nuclear, and non-nuclear industry experience. See Appendix C for results.

- The Quality Revalidation Checklist results were reviewed for acceptability.

- Both engines were partially assembled at the time of site inspection. This component was evaluated using actual walkdown information and by comparison to the Comanche Peak lead engine report.

Refer to the review procedures as described in Reference 1 for a detailed methodology for this evaluation.

IV RESULTS AND CONCLUSIONS

The small bore piping/tubing supports, as defined by this Component Design Review have been evaluated in accordance with Reference 1 and have been found acceptable with modifications.

There are no Quality Revalidation Checklist results or TERs associated with this component.

Based on the above review, and information contained in Reference 2, it is concluded that the small bore piping/tubing supports will perform their intended design function at WNP-1 under all normal operating and earthquake loadings with the provision that the following recommended modifications be implemented as detailed in Reference 3:

Engines A and B

SUMP TANK DRAIN LINE

- All restraints should utilize U-bolts of 3/8-inch diameter. Installation should be such that axial pipe movement is not restricted. All threaded connections should have locking devices installed.

In order to support the small bore piping/tubing of component 02-717F, it is recommended that the following supports be added:

Engines A and B

LUBE OIL COOLER DRAIN LINES

- A two-directional restraint is required on the lube oil cooler drain line (shell side) near the drain valves to prevent loosening of threaded connections to the vessel during a seismic event.

LUBE OIL INSTRUMENT AND VENT TUBING

- Two-directional restraints should be added at 4-foot 0-inch maximum span lengths on all auxiliary sub base piping and equipment 1/4-inch tubing upon installation. Location of restraints should consider thermal flexibility by providing a 6-inch minimum offset around bends.

Engine A

SUMP TANK DRAIN LINE

- A two-directional lateral restraint should be added near the interface flange, similar to Engine B.

V REFERENCES

1. "Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners Group", Report No. 11600.60-DC-02 Revision 0.

2. Stone & Webster Calculation number: 11600.60-NP(B)-1201-XH

3. Memo No. 6596 from C. Malovrh (SWEC) to J. Kammeyer (SWEC) dated 12/21/84.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Auxiliary Sub-Base and Oil and Water Piping-Lube Oil: Supports and Mounting Hardware (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717I

TASK DESCRIPTION NO: DR-12-02-717I-0

SNPS GPL NO. 03 717K

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Perform an engineering review of the small bore piping/tubing supports to assure that the component will perform its intended design function during normal operating and earthquake loadings.

PRIMARY FUNCTION

Provide adequate restraint of the small bore piping/tubing system, in the intended support load directions.

ATTRIBUTE TO BE VERIFIED

Structural adequacy of small bore pipe/tube supports to withstand the effects of normal operating and earthquake loadings.

SPECIFIED STANDARDS

ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition, and all addenda thereto, including winter 1974.

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Delaval design documentation (specifications, calculations, drawings, etc.). In lieu of information from Delaval, the following information is required: verified support sketches and piping isometrics, material specifications, pipe size and schedule, and operating parameters (pressure, temperature, load combinations).

GROUP CHAIRPERSON John J. Cadogan PROGRAM MANAGER K. T. Fitzpatrick for JCK

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT: Aux. Sub. Base & Oil & Water Piping - Lube Oil: Supports & Mounting Hardware

UTILITY: Washington Public Power Supply System, WNP-1

GPL NO. 02-717I

REV. NO. 2

SNPS GPL NO. 03-717K

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

2. Obtain sufficient data to support the design review effort. This may be accomplished by developing quality verified as-builts in accordance with Procedure DG-7, or by the Design Group performing a field walkdown.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

2. Information necessary for the design review effort

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package
2. Review of detailed information by the Design Group

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52
2. Procedure DG-7

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet
2. Quality verified as-built isometric drawings for the supports and mounting hardware if available from the Owner.

Engine B

Same as Engine A

GROUP CHAIRPERSON Steven M Schwartz PROGRAM MANAGER K T Fitzpatrick

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COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.

2. The Design Group will be responsible for closing out this item. This can be done per Procedure DG-7 or by the performance of an engineering walkdown by the Design Group.

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON *Vicki A. Sabol* PROGRAM MANAGER *K J Fitzpatrick*

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-717I

Effective Printout Date: 11/30/84

COMPONENT TYPE: Auxiliary Sub-Base and Oil and Water Piping
Lube Oil: Supports and Mounting Hardware

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
10CFR50.55E filed after inspection revealed ASME III Class NF code requirements were violated.	Cleveland Electric 10CFR50.55E DAR No. 117	DR/QR reviews provide assurance that components will perform their intended design functions during normal operating and earthquake loadings. The utility is responsible to verify code compliance as required.
NON-NUCLEAR		
None		

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT - UNIT 1

COMPONENT Lube Oil Heat Exchanger
UTILITY Washington Public Power Supply System
GROUP PARTS LIST NO. 02-7170
TASK DESCRIPTION NO. DR-13-02-7170-0
SNPS GPL NO. 10-104
CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry and site experience, except that already addressed in the lead report. Also, the majority of industry experience with lube oil heat exchangers has been problems with leakage, usually due to corrosion of the tubes. This is not expected to be a problem at WNP-1 since the engine jacket water, which cools the lube oil in the exchanger, will be treated with a corrosion inhibitor.

- A review of the lead engine DR/QR Report (Shoreham).

- Both WNP-1 and Comanche Peak lube oil heat exchangers are manufactured by Thermxchanger, Inc. in accordance with ASME code requirements and are single pass, shell and tube design.

The following maintenance recommendations from the lead engine DR/QR report should be implemented:

- During refueling outages, the heat exchanger tube side should be inspected to assess the condition of the tubes and the tube sheet for fouling, corrosion, and other symptoms of deterioration. Gaskets and the packing rings at the floating tube sheet should be replaced during reassembly.

- Spectrochemical analysis of lube oil samples should be performed approximately every three months to monitor the condition of the diesel engine. The results of this analysis are helpful in identifying jacket water leakage; first, by direct indication of the weight percent of water and, secondly, by interpretation of the concentration of chemical elements, which are present in the corrosion inhibitor of the jacket water system.

There are no modifications required for this component based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cudoy PROGRAM MANAGER JC Kennedy

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Before & After Lube Oil Pump

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717R

TASK DESCRIPTION NO. DR-12-02-717R-1

SNPS GPL NO. 10-113

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that already addressed in the lead engine report. There is no site experience addressed in the Component Tracking System.
- A review of the lead engine DR/QR report for Comanche Peak.
- The before and after lube oil pump at WNP-1 is the same design as the corresponding lead engine component.

A review of pump nozzle loads indicates that the applied piping loads are above the manufacturer's recommended allowables. There has however been no experience of pump leakage due to these loads at Comanche Peak or other V-16 installations. As such, the following irspection should be performed as part of the daily engine walkdown:

- The pump should be inspected for signs of leakage and corrective modifications (addition of flexible piping connections) be implemented as required.

There are no modifications recommendations for this component from the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Curley PROGRAM MANAGER K Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Oil Prelube Filter

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717S

TASK DESCRIPTION NO. DR-12-02-717S-0

SNPS GPL NO. 10-117

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience. There was no site experience listed in the Component Tracking System.
- A review of the lead engine DR/QR report (Comanche Peak).
- Both plants prelube filters are Commercial Filter Model P3-2-25FG2K1, providing 10 micron filtration.

The following maintenance from the lead engine DR/QR report should be implemented:

- Filter should be replaced before manufacturer's recommended maximum ΔP of 30 psid. WNP-1 TDI Maintenance Manual specifies filter change-out at 15 psid, which is acceptable from the viewpoint of filter design.

There are no modifications for this component based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Lube Oil System-Aux. L. O. Pump

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-717U

REV. NO. 1

SNPS GPL NO. 99-820A

TASK DESCRIPTIONS

Upon closure of NCR 1-NCR-53-23, no further review of component 02-717U is required for the following reasons:

a) There is no site or industry experience reported for this component.

b) Type C Component - Failure has little bearing on the effective use or operation of the D.G.

GROUP CHAIRPERSON Nitin A. Sacchi

PROGRAM MANAGER [illegible]

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Lube Oil System: Lube Oil Keepwarm Strainer

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717V

TASK DESCRIPTION NO. DR-12-02-717V-0

SNPS GPL NO. 99-8208

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on review of the lead engine DR/QR report (Comanche Peak). There is no reported site or industry experience in the EDG Component Tracking System for this component.

Keepwarm strainers at both plants are Air-Maze Model 07EM23L, which provide 80 micron filtration.

Maintenance from the lead engine report is to check the strainer differential pressure daily and clean/replace the strainer element at 15 psid (per TDI Manual for WNP-1), which is acceptable from the viewpoint of strainer design.

There are no modifications recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cudrogan PROGRAM MANAGER D C Kammeyer

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Misc. Equipment-Heater, Lube Oil Sump Tank UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-820A REV. NO. 1

SNPS GPL NO. 03-800B

TASK DESCRIPTIONS

No further review of component 02-820A is required for the following reasons:

a) There is no pertinent industry experience in evidence.

b) Component was reviewed on lead engine (Shoreham). The following recommendations, made in the Shoreham DR/QR report should be followed by the Washington Public Power Supply System.

Preventive maintenance included in the TDI manual should be accomplished during the lube oil sump cleaning. Inspections scheduled at 18-month intervals should consist of the following.

- Measure heater insulation resistance and replace heater if degradation of insulation resistance is noted.
- Thoroughly clean heater element of coking and other deposits and inspect for signs of deterioration.
- Check calibration and inspect condition of thermostat and recalibrate or replace thermostat when necessary.

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Full Flow Lube Oil Filter

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 84-115

TASK DESCRIPTION NO. DR-12-84-115-0

SNPS GPL NO. 10-106

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that previously addressed in the lead report. There was no site experience in tne Component Tracking System.
- A review of the lead engine DR/QR report (Comanche Peak).
- The Comanche Peak and WNP-1 full flow lube oil filters are manufactured by Commercial Filter, Model No. 1893-P9-3-6FG2k2 (10-micron) and are ASME III.

The following maintenance recommendation from the lead engine DR/QR report should be implemented:

- The TDI Instruction Manual specifies that the filter differential pressure be checked monthly and the filter element be replaced when the manufacturers maximum differential pressure of 15 psid is reached. This is acceptable from the viewpoint of filter design.

There are no modification recommendations from the lead engine DR/QR report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Carlson PROGRAM MANAGER JC Kammerer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Base and Bearing Caps - Base Assembly, Main Bearing Studs and Nuts, and Main Bearing Caps

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-305A,C,D

TASK DESCRIPTION NO. DR-12-02-305A,C,D-0

SNPS GPL NO. 03-305A,C,D

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for these components based on a review of the applicable industry and site experience listed in the EDG Component Tracking System, and the lead engine DR/QR report (Comanche Peak). The component parts at WNP-1 are the same as those at Comanche Peak.

The following maintenance items are recommended to ensure reliability of this component:

- At each refueling outage, a visual inspection of the area adjacent to the main bearing stud nut pockets of each bearing saddle should be conducted. The inspection should be done several minutes after a thorough wipe down of the surfaces. Good lighting should be used for this inspection. Any crack thus detected must be investigated further before the engine is allowed to return to service.

- The mating surfaces of the base and cap should be thoroughly cleaned with solvent before any reassembly.

There are no modification recommendations for these components.

The Quality inspections listed below are recommended to be performed:

- Verify preload torque applied to the bearing cap stud nuts during engine installation. Torque values of nuts to be in compliance with TDI manual, Engines A and B.

- Perform a visual inspection of the main bearing caps and base mating surfaces for evidence of fretting, Engines A and B.

- Perform an LP inspection of base, No. 5 main bearing saddle area, as indicated on WNP-1 Component Quality Revalidation Checklist, Task Description No. 12-02-305A. Engines A and B.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Base and Bearing Caps:
Main Bearing Studs & Nuts

COMPONENT PART NO.: 02-305C

See Component Part No.: 02-305A

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Base and Bearing Caps:
Main Bearing Caps

COMPONENT PART NO.: 02-305D

See Component Part No.: 02-305A

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT NO. 1

CRANKSHAFT
COMPONENT PART NO. 02-310A

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews to determine the adequacy of the crankshafts for their intended service at WNP-1. The primary function of the crankshaft is to convert reciprocating motion of the piston to rotary motion, and to transfer the resulting torque to the generator rotor. The manufacturer's part number the crankshafts at WNP-1 is 02-310-08-AE. The forging and machining of the crankshafts was done by Ellwood City Forge Corporation.

II OBJECTIVE

The objective of this review was to evaluate the adequacy of the crankshafts for their intended use at WNP-1.

III METHUDOLOGY

The Emergency Diesel Generator Component Tracking System records were reviewed to determine the nuclear, non-nuclear, and WNP-1 site experience of the crankshafts. WNP-1 pertinent literature specified on the Component Tracking System records was examined for information on the performance of the crankshaft (see Appendix C).

The TDI Holzer calculations were reviewed by comparing the results with those obtained from vibrational analysis (Refs. 1 and 3).

A modal superposition analysis of the crankshaft was performed. The pressure loading was obtained from the dynamic test at Shoreham Nuclear Power Station (Ref. 2). This analysis calculates the nominal shear stresses at each crankpin and main journal location.

The stress levels in the main journal oil holes were compared with the endurance limit.

The Component Quality Revalidation Checklist results were reviewed for acceptability.

IV RESULTS AND CONCLUSIONS

The TDI Holzer calculations were found to be accurate. The torsiograph test has not been conducted to date. The results of the torsiograph test should be compared with the TDI Holzer calculations and the vibrational analysis when available.

The modal superposition analysis determined the maximum amplitude of nominal stress to be 5352 psi between cylinder numbers 5 and 6 for a load at 7000 kW (Ref. 3). The nominal stresses were found to satisfy the requirements of DEMA, and are less than 5000 psi for a single order, and less than 7000 psi for combined orders (Ref. 4).

The material certification reports for the crankshafts at WNP-1 indicate that the tensile strengths for the crankshaft material in Engines Serial Nos. 75084 and 75085 are within the original design specifications (Refs. 5). The factor of safety against fatigue failure in the main journal oil holes was found to be 1.46 based on a minimum ultimate tensile strength of 92.5 ksi for Engine Serial No. 75085 (Ref. 3).

There are no TERs associated with this component.

The WNP-1 Component Quality Revalidation Checklist has been reviewed in preparation of this report. Since no documents are in evidence that fulfill these requirements, it is recommended that the Quality Revalidation Inspections listed in Appendix B be performed.

Based on the above review, it is concluded that the crankshafts in Engine Serial Nos. 75084 and 75085 are acceptable for their intended function at WNP-1 provided that a torsiograph test verifies that the actual level of stress does not exceed that calculated and that crankshaft inspections verify that the vital areas are free of unacceptable flaws.

V REFERENCES

1. Yang, Roland, "Torsional and Lateral Critical Speed Analysis: Engine Numbers 75084/85 Delaval-Enterprise Engine Model DSRV-16-4 7060 kW, 9783 BHP at 450 rpm," for Washington Public Power Supply System," Transamerica Delaval Inc., Engine and Compressor Division, Oakland, California, dated 8-20-76.

2. "Evaluation of Emergency Diesel Generator Crankshafts at Shoreham and Grand Gulf Nuclear Power Stations," Report No. FaAA-84-3-16, Failure Analysis Associates, Palo Alto, California, May 22, 1984.

3. FaAA Support Package 84-6-10(k).

4. Standard Practices for Low and Medium Speed Stationary Diesel and Gas Engines, Diesel Engine Manufacturers Association, 6th ed., 1972.

5. "Test Report(s)," Heat Numbers 62773-2 and 61160-3, both dated 5-7-76, by Ellwood City Forge Corporation, Ellwood City, Pennsylvania.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Crankshaft

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-310A

TASK DESCRIPTION NO. DR-12-02-310A-0

SNPS GPL NO. 03-310A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Review of WNP-1 site, nuclear and non-nuclear experience.

Review of TDI Holzer calculations and torsiograph tests.

Perform modal superposition of the crankshaft.

Compare stress levels at the oil holes with the endurance limit.

Review Quality Revalidation Checklist for acceptability.

Review information provided on TERs.

PRIMARY FUNCTION

The crankshaft converts reciprocating motion, component inertial forces, and gas pressure piston forces to rotary motion and torque at the output flange.

ATTRIBUTE TO BE VERIFIED

Sufficient strength, stiffness, frequency characteristics: material properties, surface finish, and bearing characteristics for EDG service.

SPECIFIED STANDARDS

Standard Practices for Low and Medium Speed Stationary Diesel and Gas Engines, Diesel Engine Manufacturer's Association; 6th ed., 1972.

REFERENCES

None

DOCUMENTATION REQUIRED

TDI drawings, test reports, experimental pressure vs. time curves, Holzer calculations for DSRV-16-4 engine.

GROUP CHAIRPERSON John F Cadogan PROGRAM MANAGER K. F. Fitzpatrick

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Crankshaft & Bearings - Crankshaft & Turning Gear

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-310A

REV. NO. 1

SNPS GPL NO. 03-310A

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.
2. Perform a visual inspection of all crankpin and main journals for signs of scoring, wear or damage. Document with photographs.
3. Perform an Eddy Current test on the main journal oil holes 4, 6 and 8. If inspection is unsatisfactory perform an Eddy Current test on the remaining main journal oil holes and on all crankpin journal oil holes.
4. Perform a torsiograph on the crankshaft.

Engine B

1. Assemble and review existing documentation.
2. Perform a visual inspection of all crankpin and main journals for signs of scoring wear or damage. Document with photographs.
3. Perform an Eddy Current test on the main journal oil holes 4, 6 and 8. If inspection is unsatisfactory perform an Eddy Current test on the remaining main journal oil holes and on all crankpin journal oil holes.

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

ATTRIBUTES TO BE VERIFIED (continued)

Engine A (continued)

2-3. Surface integrity of crankpin and main journals

4. Stress on the crankshaft

Engine B

1. Quality status of Component Document Package

2-3. Surface integrity of the crankpin and main journals

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package

2. Review of inspection report by the Design Group

3. See Attachment A

4. Review of inspection report by the Design Group

Engine B

1. Satisfactory Document Package

2-3. Review of inspection report by the Design Group

REFERENCES

Engine A

1. QCI No. 52

2. Approved Site NDE Procedures

3. Approved Site NDE Procedures, TER# 99-015

4. Approved Site NDE Procedures

REFERENCES (continued)

Engine B

1. QCI No. 52

2-3. Approved Site NDE Procedures

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet

2-4. Inspection Report

Engine B

1. Document Summary Sheet

2-3. Inspection Report

GROUP CHAIRPERSON Nita A. Salata PROGRAM MANAGER DC Kennedy

COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.

2-4. No inspection reports have been received which fulfill these requirements.

Engine B

1. No EDGCTS site experience documents are in evidence.

2-3. No inspection reports have been received which fulfill these requirements.

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON Victor A. Falcetta PROGRAM MANAGER JC Kammeyer

TABLE 1

Main Journal Oil Hole Inspections for DSRV-16-4 Crankshafts

Journal Location	Depth of Notch* (mils)		
	0" to 1" from Journal Surface	1" to 2" from Journal Surface	2" to 3" from Journal Surface
Front End	No inspection	No inspection	No inspection
Between Cylinders 1 and 2	40	No inspection	No inspection
Between Cylinders 2 and 3	30	40	No inspection
Between Cylinders 3 and 4+	10	15	20
Between Cylinders 4 and 5	10	15	30
Between Cylinders 5 and 6+	10	15	20
Between Cylinders 6 and 7	10	15	30
Between Cylinders 7 and 8+	10	15	20
Flywheel End	15	20	40

TABLE 2

Crankpin Oil Hole Inspections for DSRV-16-4 Crankshafts

Crankpin Location	Depth of Notch* (mils)		
	0" to 1" from Journal Surface	1" to 2" from Journal Surface	2" to 3" from Journal Surface
Cylinder 1	No inspection	No inspection	No inspection
Cylinder 2	No inspection	No inspection	No inspection
Cylinder 3	20	30	40
Cylinder 4	20	30	40
Cylinder 5	20	30	40
Cylinder 6	20	30	40
Cylinder 7	20	30	40
Cylinder 8	20	30	40

* Width of notch is twice the depth.
+ Initial inspection - only inspect remaining locations if initial inspection is unsatisfactory.

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 03-310A

Effective Printout Date: 11/31/84

COMPONENT TYPE: Crankshaft

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
While feeding steam generators with the diesel driven auxiliary feed pump, the diesel tripped on low lube oil pressure. Steam generator level was maintained by using the steam driven auxiliary feed pump. The diesel failure was due to a broken crankshaft. Inspection of the engine did not reveal a cause for the failure. A metallurgical analysis of the crankshaft is being conducted. Manufacturer: Electro-Motive Div. of GM.	LER, Trojan; 344-7700, 770324	Failure of a different design crankshaft. Crankshaft at WNP-1 is adequately designed.
During performance of surveillance procedures, 2303-N16 "Emergency Diesel Generator and Cooling Water Valve Operability Test," the "B" diesel generator failed to start. The redundant emergency diesel generator was operable. Cause was attributed to improper material in vertical shaft between upper and lower crankshaft. Manufacturer: Fairbanks-Morse	EPRI TMI 2, 052078, DG-28	Not a crankshaft failure.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
A Delaval diesel generator at Shoreham fractured its crankshaft at the crankpin and crankarm. Examination of 2 other diesels showed cracks on the crankshaft and crankpin bearing failure. Manufacturer: TDI	I&E Shoreham notice 83-58, 08/30/83	Problem associated with inadequate design. WNP-1 crankpins are adequately designed.
Cylinder No. 4 had excessive threading (grooved radially) on the crankshaft bearing. The crankpin was discolored and the cylinder liner was grooved in 3 places: 10 inches long by 1/16 inch deep. Manufacturer: TDI.	10CFR50.55E MP&L Grand Gulf 12/10/81, 04/15/82.	Problem not related to design.
Info-procedure to measure crankshaft thrust clearance. Manufacturer: TDI.	TDI SIM 283	No impact on adequacy of crankshafts.
Crankshaft overall lengths have increased and therefore require a modified inspection cover. Installation is prevented becaused of interference with the lube oil strainer. Interference may be eliminated by effecting reduction in the length of the cover by reducing the flange thickness and facing the end plate from 11/16-inch to ¼-inch thickness.	TDI Letter to LILCO 01/10/84 S/N 74010/12 to Mike Herlihy (LILCO)	No impact on adequacy of crankshafts.
Info-instructions for flushing lube oil header.	TDI SIM 141	No impact on adequacy of crankshafts.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
NON-NUCLEAR		
Crankshaft oil way plugs cracking from the use of improper gauge of material issued for plugs. (M/V Pride of Texas)	Titan Navigation, Inc., Letter dated July 22, 1982	Per phone conversation with site personnel, oil hole plugs at WNP-1 use thicker gauge material.
Experienced engine vibration at crankshaft due to vibration damper coupling failure. (M/V Columbia)	Hunton & Williams (12/29/83) to C. Seaman. Letter from M. Zbinden (State of Alaska) to D. Martini (TDI) dated 03/19/79. Letter from M. Zbinden to W. Hudson dated 02/02/79.	Not applicable since engines at WNP-1 do not have vibration dampers.
Currently checking the cause of excessive main engine crankshaft distortion. (M/V Columbia)	Hunton & Williams (12/29/83) to C. Seaman. Memo from M. Zbinden (State of Alaska) to R. Ward dated 12/10/80.	Insufficient information in reference document for evaluation.
During normal operation engine experienced a low lube oil pressure alarm. Engine was shut down for inspection and two cracks were found at the No. 5 crank pin.	Failure Analysis Report No. 0135 12/10/80 (File T-39). Memo TDI H. Schilling 12/15/80 to G.E. Trussell (File T-1). Memo TDI H. Schilling 12/14/80 to G.E. Trussell (File T-1).	Resulted from inadequate repair following failure of another component.
Crankshaft failed at No. 6 main bearing journal. Indications started at discontinuity that is located about 3/4-inch from oil hole opening. Failure was caused by fatigue.	Failure Analysis Report No. 0124 dated 12/11/79 (File T-16).	Not applicable since this engine had a 4th order critical at operating speed, and WNP-1 does not.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
A bend is suspected on the crankshaft and the shaft consequently does not have the required support from each bearing, the risk of cracking is prevalent because of fatigue stressing during operation and load variations.	Telex from Bailey (TDI) to Delaval HQ. (File T-33). Enclosure 2 to SWEC letter dated 04/29/81 by G. Sandstrom (File T-36).	No indication of a bent crankshaft at WNP-1.
Broken crankshaft and further extensive damage to the engine. City of St. Cloud, Fla.	Letter from Village of Rockville Centre to Smith & Gillespie Eng. Inc. 11/09/81 Eng. DG-SRV-16-4 Unit No. 7 City of St. Cloud (File T-63).	Resulted from failure of another component.
The original crankshaft was bent during the overspeed.	Sales order No. W-25354 07/13/81. Rafha Electric Co. Eng. No. 79003. Model DSR-F48 (File T-57)	No indication of a bent crankshaft at WNP-1.
Repaired crankshaft No. 2 crankpin journal was reduced in diameter by 0.273 thousandths of an inch.	Telex from C. Just to Pratt (TDI) 07/27/83	Not relevant to design considerations at WNP-1.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Main Bearings

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-310B

TASK DESCRIPTION NO. DR-12-02-310B-0

SNPS GPL NO. 03-310B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- The DR/QR report for the lead engine at Comanche Peak included analysis of the main bearing shells and determined that they were acceptable for their intended application with a margin of safety suitable for small variations in loading and oil film pressures.

- The diesel engines at WNP-1 and Comanche Peak use identical bearing shells (TDI Part Numbers R-3313, R-3315 and R-3317). The engine operating parameters, main engine components, and loads at WNP-1 are similar to those at Comanche Peak.

A review of the nuclear and non-nuclear experiences listed in the EDG Component Tracking System reports several diesels were found with overheated and scored bearings. These problems were caused by abnormal operating conditions involving contaminated oil or loss of lubrication, and not because of the bearing design. There is no site experience listed for this component.

Because of the low operating hours on the engines, it is recommended that at the first refueling outage the main bearings be inspected for evidence of misalignment. If harmful misalignment is discovered, corrective procedures should be implemented.

There are no modification recommendations for this component.

The following Quality inspections should be performed to assure component quality:

- Perform a dimensional check of the bearing shell to verify thickness is within TDI specifications.

- Perform a visual or liquid penetrant inspection of the main bearing shells for signs of scoring, galling or cracking. Minimum sample to be the #5 main bearing shell.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Crankshaft & Bearings: Thrust Bearing Ring

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-310C

TASK DESCRIPTION NO. DR-12-02-310C-0

SNPS GPL NO. 03-310C

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the Comanche Peak and Shoreham DR/QR reports which establish the acceptability of the thrust bearing ring assembly for its intended purpose.
- The applicable engine dimensions and operating parameters at WNP-1 are identical or very similar to those for the same component at Comanche Peak (lead engine).
- A review of the EDG Component Tracking System indicated that there was no site experience and no significant applicable nuclear or non-nuclear industry experience.

Maintenance recommendations based on the Comanche Peak DR/QR report to ensure proper performance under normal operating conditions are as follows:

- Measure thrust bearing ring clearance via "bump check" method to be performed in conjunction with crankshaft web deflection measurements at every outage. If the clearance is greater than the maximum allowed in the TDI Instruction Manual, then at least one bearing must be replaced. Bearings should also be replaced if they are cracked or gouged.
- Visually inspect thrust bearing ring for signs of cracks, gouges, wear or degradation at alternate outages. This inspection should be performed simultaneously with the main bearing shell inspection.

There are no modification recommendations for this component.

No Quality revalidation is required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Crankcase: Crankcase Assembly UTILITY Washington Public Power Supply Syst

GROUP PARTS LIST NO. 02-311A TASK DESCRIPTION NO: DR-12-02-311A-0

SNPS GPL NO. 99-311A CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review of this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry experience. There is no reported site experience in the EDG Component Tracking System for this component.

The crankcase at WNP-1 is the same part number as the one used at Comanche Peak (TDI P/N 02-311-03-AL), which is considered acceptable for its intended service.

The maintenance recommendation for this component is as follows:

- Perform a visual examination of the vertical crankcase arch wall and the crankcase-to-base nut pocket area. This inspection should be performed during each refueling outage. The first inspection, which occurs after 185 hours, at or near full load, can be used to justify the discontinuation of future inspections.

There are no modification recommendations for this component.

The following Quality inspection should be performed on all station engines:

- Perform a visual examination of the vertical crankcase arch wall and crankcase-to-base nut pocket area for machined surfaces with sharp corners. Crankcase vertical arch wall should be as-cast surface. Nut pocket shall be free of cracks.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

Note: If findings are unacceptable, analytical methods and increased surveillance will be used to justify continued operation. Hardware replacement is not practical for this component.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Crankcase: Crankcase Assembly UTILITY Washington Public Power Supply Syst

GROUP PARTS LIST NO. 02-311A TASK DESCRIPTION NO: DR-12-02-311A-0

SNPS GPL NO. 99-311A CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review of this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry experience. There is no reported site experience in the EDG Component Tracking System for this component.

The crankcase at WNP-1 is the same part number as the one used at Comanche Peak (TDI P/N 02-311-03-AL), which is considered acceptable for its intended service.

The maintenance recommendation for this component is as follows:

- Perform a visual examination of the vertical crankcase arch wall and the crankcase-to-base nut pocket area. This inspection should be performed during each refueling outage. The first inspection, which occurs after 185 hours, at or near full load, can be used to justify the discontinuation of future inspections.

There are no modification recommendations for this component.

The following Quality inspection should be performed on all station engines:

- Perform a visual examination of the vertical crankcase arch wall and crankcase-to-base nut pocket area for machined surfaces with sharp corners. Crankcase vertical arch wall should be as-cast surface. Nut pocket shall be free of cracks.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

GROUP CHAIRPERSON J J Powers PRGORAM MANAGER K Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Crankcase: Crankcase Mounting Hardware

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-311D

TASK DESCRIPTION NO. DR-12-02-311D-0

SNPS GPL NO. 99-311C

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for this component based on the Comanche Peak DR/QR report (the crankcase mounting hardware used at WNP-1 is identical to that used at Comanche Peak) and the fact that there is no applicable site or industry experience in the EDG Component Tracking System.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Crankcase: Crankcase Gaskets and Mounting Hardware

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-386B

TASK DESCRIPTION NO. DR-12-02-386B-0

SNPS GPL NO. 99-386B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable site and industry experience.

A review of site and industry experience indicates that there have been some instances of bolting failures caused by undertorquing, which resulted in fatigue failures, or overtorquing, which resulted in shear failures. These failures are not attributed to design deficiencies of this component. The recommended torque values are appropriate, and the specified bolting and stud materials (SAE GR 5 and SAE GR 1120, respectively) are acceptable for their intended function of holding the covers onto the crankcase. Isolated failures can occur when the torque is not applied properly or a lesser grade material is substituted. Barring any deviations as mentioned above, the bolting is acceptable for use on the diesel engines.

There are no modification or maintenance recommendations for this component.

The following Quality inspection should be performed on all engines:

- Review the existing documentation or physically verify that the bolt torques are in accordance with the TDI manual.
- Verify that no cracking exists, at the bolt holes of covers.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Curlogo PROGRAM MANAGER K.L. Fitzpatrick for JCK

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

CYLINDER BLOCK
COMPONENT PART NO. 02-315A

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the cylinder blocks to determine the adequacy of design for the intended use at WNP-1. The blocks are manufactured by TDI and are supplied under their part number 02-315-03-AE. The cylinder block forms the framework of the liquid cooled engine and provides passage for coolant and support for the cylinder liners and cylinder heads.

II OBJECTIVE

The objective of this review was to evaluate the structural adequacy of the cylinder block for its intended use at WNP-1.

III METHODOLOGY

In order to meet the stated objective, the following methods were used:

- Review of WNP-1 site, nuclear and non-nuclear experiences (see Appendix C).
- Review of engine operating conditions at WNP-1 and identification of any differences from those at Comanche Peak.
- Performance of dimensional check and evaluation of cylinder liner/block interaction.
- Evaluation of steady state stresses, alternating stresses and stiffness in key portions of the cylinder block.
- Evaluation of crack growth rate for cylinder block landing and counterbore diameter by comparison with conservative Shoreham data and analysis.
- Review of liquid penetrant inspections of WNP-1 DSRV-16-4 A and B engine blocks.
- Review of metallurgical/microstructural analysis of cylinder block top material.

- Review of Component Quality Revalidation Checklist results for acceptability.

IV RESULTS AND CONCLUSIONS

A generic investigation of the structural adequacy of the TDI R-4 and RV-4 series diesel engine cylinder blocks for emergency standby service in nuclear power plants is summarized in Reference 1. The investigation considers the cause, extent, and consequences of cylinder block cracking, and the inspections required to assure sufficient margin of safety during continued operation under test and postulated accident conditions.

Evaluation of steady state stresses, alternating stresses and stiffness in key portions of the cylinder block was accomplished as part of the strain gauge testing at Shoreham and the results were included in the cumulative damage and crack growth analyses. The cumulative damage algorithm is explained in Reference 1.

Diesel generators A and B have had limited operational experience. Engine hours accumulated to date consist of test hours performed by TDI at the factory.

The engine operating conditions at WNP-1 were compared to those at Comanche Peak and Shoreham. No significant differences were found that would affect the structural integrity assessment of the WNP-1 blocks.

It is recommended that liner bore and mating block dimensions be checked in order to evaluate the interaction of the block and liner. These results are utilized in applying the cumulative damage methodology outlined in Figure 5-1 of Reference 1. For the purpose of analyzing the steady state and alternating stresses present, the cylinder block material is assumed to be characteristic of typical Class 40 grey cast iron and liner/block bore interaction is assumed to be similar to that present at Shoreham. These assumptions must be verified prior to placing these engines into emergency standby service.

The power output for this engine is 7000 kW at 100 percent rated load. The output required for a load profile enveloping both a LOOP and LOOP/LOCA is 7376 kW for 1 hour 6893 kW for 6 hours, 6485 kW for 13 hours, 6379 kW for 6 hours, and 5890 kW for 142 hours (Ref. 3).

Strain gauge testing of the original Shoreham EDG 103 block, inspection data from before and after testing, and materials testing were used as a basis to predict adequate life for cylinder blocks. The apparent rate of propagation of cracks between stud holes in the original Shoreham EDG 103 block, when compared with the LOOP and LOOP/LOCA envelope requirements, indicates that even if the WNP-1, blocks 1B Right, 2A Right and 2A Left had ligament cracks, they are predicted to withstand with sufficient margin a LOOP or LOOP/LOCA event. Engine block 1B left has been shown to have degenerative Widmanstatten Graphite. Consequently, continued engine operation with sufficient margin for a LOOP or LOOP/LOCA event is justified only if block top inspections result in no detectable block top cracks.

To date, no inspection results for Engine A and B blocks tops have been reported. It is recommended that, prior to placing the engines in emergency standby service, the visual and NDE examinations consistent with those identified in Appendix B be performed on Engines A and B to determine whether or not block top cracks are present.

Microstructural evaluations of WNP-1 engine 2A and 1B blocks have been performed and indicate that the left block of engine 1B contains degenerate Widmanstatten graphite. Engine blocks 1B Right, 2A Right, and 2A Left are characteristic of typical Class 40 grey cast iron.

Application of the cumulative damage algorithm Figure 5-1 of Reference 1 shows that provided WNP-1 blocks have no detectable block top cracks continued operation without inspection is justified for the following time periods at full power (7000 Kw) or operation resulting in equivalent cumulative damage with sufficient margin for a LOOP or LOOP/LOCA event (Reference 2):

Engine 1B Left	9 hours
Engine 1B Right	583 hours
Engine 2A Right and Left	583 hours

If block top inspection results for engine block 1B Left show the presence of block top cracks, there is no analytic basis for futher engine operations. Block top cracks in the 1B Right, 2A Right, and 2B Left engine blocks will effect future inspection intervals as shown in Figure 5.1 of Reference 1.

Engine operation in excess of the time periods listed above without inspection could be justified if the fatigue damage index since the last inspection has not exceeded the allowable fatigue damage index before the last inspection. In the future after additional engine operation without inspection has been accumulated, additional engine operation may be performed after removal of the cylinder heads and inspection of the block top for detectable ligament, stud-to-stud or stud-to-end cracks. If none are found, then additional engine operation without inspection may be performed until the future fatigue damage index equals the allowable fatigue damage index accrued to the last inspection. This process may be repeated indefinitely throughout the life of the engine.

Optionally, in the future, after additional engine operation without inspection has been accumulated and the fatigue damage index for future operations exceeds the allowable fatigue damage index, continued engine operation without removal of cylinder heads and inspection of the block top will allow sufficient margin to withstand a LOOP or LOOP/LOCA event provided periodic eddy current inspections are performed. The periodic eddy current inspections are described in Figure 5-1 of Reference 1.

The information provided on TER 12-003 has been reviewed and is consistent with the final conclusions of this report.

Results of the Quality Revalidation Inspections performed to date have been reviewed and considered in the performance of this design review, and the results are consistent with the final conclusions of this report.

Based on the above review, subsequent completion and review of block top inspections, and cylinder liner/block bore dimensional check as identified in Appendix B for Engines A and B, and implementation of routine inspections, it is concluded that the cylinder blocks are acceptable for their intended use at WNP-1.

IV REFERENCES

1. Design Review of TDI-R4 and RV-4 Series Emergency Diesel Generator Cylinder Blocks. FaAA-84-9-11.

2. FaAA Support Package Number SP-84-9-11(k).

3. Telecon between S. Rau (FaAA) and C. Kinsel (United Engineers and Constructors) on 01/08/85.

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

CYLINDER BLOCK
COMPONENT PART NO. 02-315A

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the cylinder blocks to determine the adequacy of design for the intended use at WNP-1. The blocks are manufactured by TDI and are supplied under their part number 02-315-03-AE. The cylinder block forms the framework of the liquid cooled engine and provides passage for coolant and support for the cylinder liners and cylinder heads.

II OBJECTIVE

The objective of this review was to evaluate the structural adequacy of the cylinder block for its intended use at WNP-1.

III METHODOLOGY

In order to meet the stated objective, the following methods were used:

- Review of WNP-1 site, nuclear and non-nuclear experiences (see Appendix C).
- Review of engine operating conditions at WNP-1 and identification of any differences from those at Comanche Peak.
- Performance of dimensional check and evaluation of cylinder liner/block interaction.
- Evaluation of steady state stresses, alternating stresses and stiffness in key portions of the cylinder block.
- Evaluation of crack growth rate for cylinder block landing and counterbore diameter by comparison with conservative Shoreham data and analysis.
- Review of liquid penetrant inspections of WNP-1 DSRV-16-4 A and B engine blocks.
- Review of metallurgical/microstructural analysis of cylinder block top material.

- Review of Component Quality Revalidation Checklist results for acceptability.

IV RESULTS AND CONCLUSIONS

A generic investigation of the structural adequacy of the TDI R-4 and RV-4 series diesel engine cylinder blocks for emergency standby service in nuclear power plants is summarized in Reference 1. The investigation considers the cause, extent, and consequences of cylinder block cracking, and the inspections required to assure sufficient margin of safety during continued operation under test and postulated accident conditions.

Evaluation of steady state stresses, alternating stresses and stiffness in key portions of the cylinder block was accomplished as part of the strain gauge testing at Shoreham and the results were included in the cumulative damage and crack growth analyses. The cumulative damage algorithm is explained in Reference 1.

Diesel generators A and B have had limited operational experience. Engine hours accumulated to date consist of test hours performed by TDI at the factory.

The engine operating conditions at WNP-1 were compared to those at Comanche Peak and Shoreham. No significant differences were found that would affect the structural integrity assessment of the WNP-1 blocks.

It is recommended that liner bore and mating block dimensions be checked in order to evaluate the interaction of the block and liner. These results are utilized in applying the cumulative damage methodology outlined in Figure 5-1 of Reference 1. For the purpose of analyzing the steady state and alternating stresses present, the cylinder block material is assumed to be characteristic of typical Class 40 grey cast iron and liner/block bore interaction is assumed to be similar to that present at Shoreham. These assumptions must be verified prior to placing these engines into emergency standby service.

The power output for this engine is 7000 kW at 100 percent rated load. The output required for a load profile enveloping both a LOOP and LOOP/LOCA is 7376 kW for 1 hour 6893 kW for 6 hours, 6485 kW for 13 hours, 6379 kW for 6 hours, and 5890 kW for 142 hours (Ref. 3).

Strain gauge testing of the original Shoreham EDG 103 block, inspection data from before and after testing, and materials testing were used as a basis to predict adequate life for cylinder blocks. The apparent rate of propagation of cracks between stud holes in the original Shoreham EDG 103 block, when compared with the LOOP and LOOP/LOCA envelope requirements, indicates that even if the WNP-1, blocks 1B Left, 2A Right and 2A Left had ligament cracks, they are predicted to withstand with sufficient margin a LOOP or LOOP/LOCA event. Engine block 1B Right has been shown to have degenerative Widmanstatten Graphite. Consequently, continued engine operation with sufficient margin for a LOOP or LOOP/LOCA event is justified only if block top inspections result in no detectable block top cracks.

To date, no inspection results for Engine A and B blocks tops have been reported. It is recommended that, prior to placing the engines in emergency standby service, the visual and NDE examinations consistent with those identified in Appendix B be performed on Engines A and B to determine whether or not block top cracks are present.

Microstructural evaluations of WNP-1 engine 2A and 1B blocks have been performed and indicate that the right block of engine 1B contains degenerate Widmanstatten graphite. Engine blocks 1B Left, 2A Right, and 2A Left are characteristic of typical Class 40 grey cast iron.

Application of the cumulative damage algorithm Figure 5-1 of Reference 1 shows that provided WNP-1 blocks have no detectable block top cracks continued operation without inspection is justified for the following time periods at full power (7000 Kw) or operation resulting in equivalent cumulative damage with sufficient margin for a LOOP or LOOP/LOCA event (Reference 2):

Engine 1B Right	9 hours
Engine 1B Left	583 hours
Engine 2A Right and Left	583 hours

If block top inspection results for engine block 1B Right show the presence of block top cracks, there is no analytic basis for futher engine operations. Block top cracks in the 1B Left, 2A Right, and 2B Left engine blocks will effect future inspection intervals as shown in Figure 5.1 of Reference 1.

Engine operation in excess of the time periods listed above without inspection could be justified if the fatigue damage index since the last inspection has not exceeded the allowable fatigue damage index before the last inspection. In the future after additional engine operation without inspection has been accumulated, additional engine operation may be performed after removal of the cylinder heads and inspection of the block top for detectable ligament, stud-to-stud or stud-to-end cracks. If none are found, then additional engine operation without inspection may be performed until the future fatigue damage index equals the allowable fatigue damage index accrued to the last inspection. This process may be repeated indefinitely throughout the life of the engine.

Optionally, in the future, after additional engine operation without inspection has been accumulated and the fatigue damage index for future operations exceeds the allowable fatigue damage index, continued engine operation without removal of cylinder heads and inspection of the block top will allow sufficient margin to withstand a LOOP or LOOP/LOCA event provided periodic eddy current inspections are performed. The periodic eddy current inspections are described in Figure 5-1 of Reference 1.

The information provided on TER 12-003 has been reviewed and is consistent with the final conclusions of this report.

Results of the Quality Revalidation Inspections performed to date have been reviewed and considered in the performance of this design review, and the results are consistent with the final conclusions of this report.

Based on the above review, subsequent completion and review of block top inspections, and cylinder liner/block bore dimensional check as identified in Appendix B for Engines A and B, and implementation of routine inspections. it is concluded that the cylinder blocks are acceptable for their intended use at WNP-1.

IV REFERENCES

1. Design Review of TDI-R4 and RV-4 Series Emergency Diesel Generator Cylinder Blocks. FaAA-84-9-11.

2. FaAA Support Package Number SP-84-9-11(k).

3. Telecon between S. Rau (FaAA) and C. Kinsel (United Engineers and Constructors) on 01/08/85.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Cylinder Block-Liners and Water Manifold: Cylinder Block

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-315A

TASK DESCRIPTION NO. DR-12-02-315A-0

SNPS GPL NO. 03-315A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Review liquid penetrant inspections of WNP-1 DSRV-16-4 engine block tops and review engine operating experience.

Review engine operating conditions of WNP-1 and identify any differences from those at Comanche Peak.

Perform dimensional check on cylinder block and cylinder liners and evaluate liner/block interaction.

Evaluate steady state stresses, alternating stresses and stiffness in key portions of the cylinder block.

Evaluate crack growth rate for cylinder block landing and counterbore diameter by comparison with conservative Shoreham data and analysis.

Review metallurgical/microstructural analysis of cylinder block top material.

Review of Perry site, nuclear and non-nuclear experiences (see Appendix C).

Review of Quality Revalidation Checklist results for acceptability.

Review information provided on TERs.

PRIMARY FUNCTION

To provide framework for engine components and to provide cooling water passages.

ATTRIBUTE TO BE VERIFIED

That components have sufficient strength and stiffness to react major loads.

SPECIFIED STANDARDS

None.

REFERENCES

None.

DOCUMENTATION REQUIRED

Manufacturer's drawings for DSR-48 and RV blocks, liners and studs, including all specifications for material, torques, valve train loads and gas cycles.

Engine operating history (time vs. load) for operation prior to block top inspection, and for total engine hours.

Anticipated engine operating profile (time vs. load) for fuel cycle, including pre-operational, qualification, and surveillance testing.

Engine factory test logs that report firing pressures and exhaust temperatures for each cylinder.

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Cylinder Block

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-315A

REV. NO. 2

SNPS GPL NO. 03-315A

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

2. Perform a dimensional check on the area around the cylinder liner for all cylinder block liner landings.

3. Perform a Liquid Penetrant or Magnetic Particle test on the cylinder block liner landing along the top landing surface, fillet radius, and vertical face adjacent to the landing surface. Liner landings 3L, 4L, 5L, 6L, 3R, 4R, 5R, and 6R should be inspected with the liners removed. If linear indications are found, increase inspection plan to all liner landings.

4. Perform a Liquid Penetrant or Magnetic Particle test on the cylinder head mating surface on top of the cylinder block. The area between stud hole and liner, and between adjacent cylinder stud hole should be inspected. The inspection plan should include cylinders 3L, 4L, 5L, 6L, 3R, 4R, 5R and 6R. If linear indications are found, increase inspection plan to all cylinders.

5. Perform an Eddy Current test on the cylinder head stud holes if required (i.e., linear indications found at stud hole extending into threads).

6. Remove a sample from each cylinder block by drilling and cutting. The samples shall be tetrahedral in shape with a one inch square base and a height of 5/8 inch. Attachment B shows the locations where the samples should be taken.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

2. Dimensions of the cylinder block liner landing area

3-5. Surface integrity of the cylinder block liner landing

6. Samples taken from the cylinder block are in accordance with TER# 99-016.

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package

2. See attachments C, D and E. Liner dimensions must be in accordance with one of these drawings.

3-4. See Attachment A

5-6. Review of inspection report by the Design Group

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52

2. Approved Site NDE Procedures, TER# 99-050

3-4. TER# 99-004, 99-018, 99-036

5. FaAA Procedure NDE 11.8

6. TER#s 99-016, 99-031

REFERENCES (continued)

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet

2-6. Inspection Report

Engine B

Same as Engine A

GROUP CHAIRPERSON Steve M Schmidt PROGRAM MANAGER J C Kammeyer

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COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.

2-5. No inspection reports have been received which fulfill these requirements.

6. Samples were taken from each block as required and forwarded to design for analysis.

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

RESULTS AND CONCLUSION (continued)

Engine B

Same as Engine A

GROUP CHAIRPERSON Victor A Soleta PROGRAM MANAGER K Kennedy

ACCEPTANCE CRITERIA

A. Area to be inspected

1. Top of Block
2. Liner counterbore

B. Reference Standard ASTM E125

C. Evaluation of indications

1. Relevant indications are:
   a. Hot tears and cracks, linear indications that exceed ASTM E125 Class I-2
   b. Shrink that exceeds ASTM E125 Class II-3
   c. Inclusions that exceed ASTM E125 Class III-3
   d. Porosity that exceeds ASTM E125 Class V-1
2. All indications exceeding the specification listed above shall be documented and submitted to the Design Group.
3. Indications that do not exceed the ASTM E125 reference regardless of size and quantity are acceptable.

D. Non-Relevant Indication

1. The indications referenced below shall be considered non-relevant.
   a. Magnetic writing
   b. Linear grain boundaries (carbon, ferrite, or graphite induced)
   c. Rounded grain boundaries (carbon, ferrite, or graphite induced)

TYP. EITHER END
5/8"
1"
SEE ISOMETRIC DETAIL A-A
NOTE 1
DRILL 4 HOLES
3/32" DIA. 45° ∠
& CUT OUT PIECE
1"
SEE NOTE 1
ISOMETRIC DETAIL A-A
(DARKENED AREA INDICATES

ENGINES

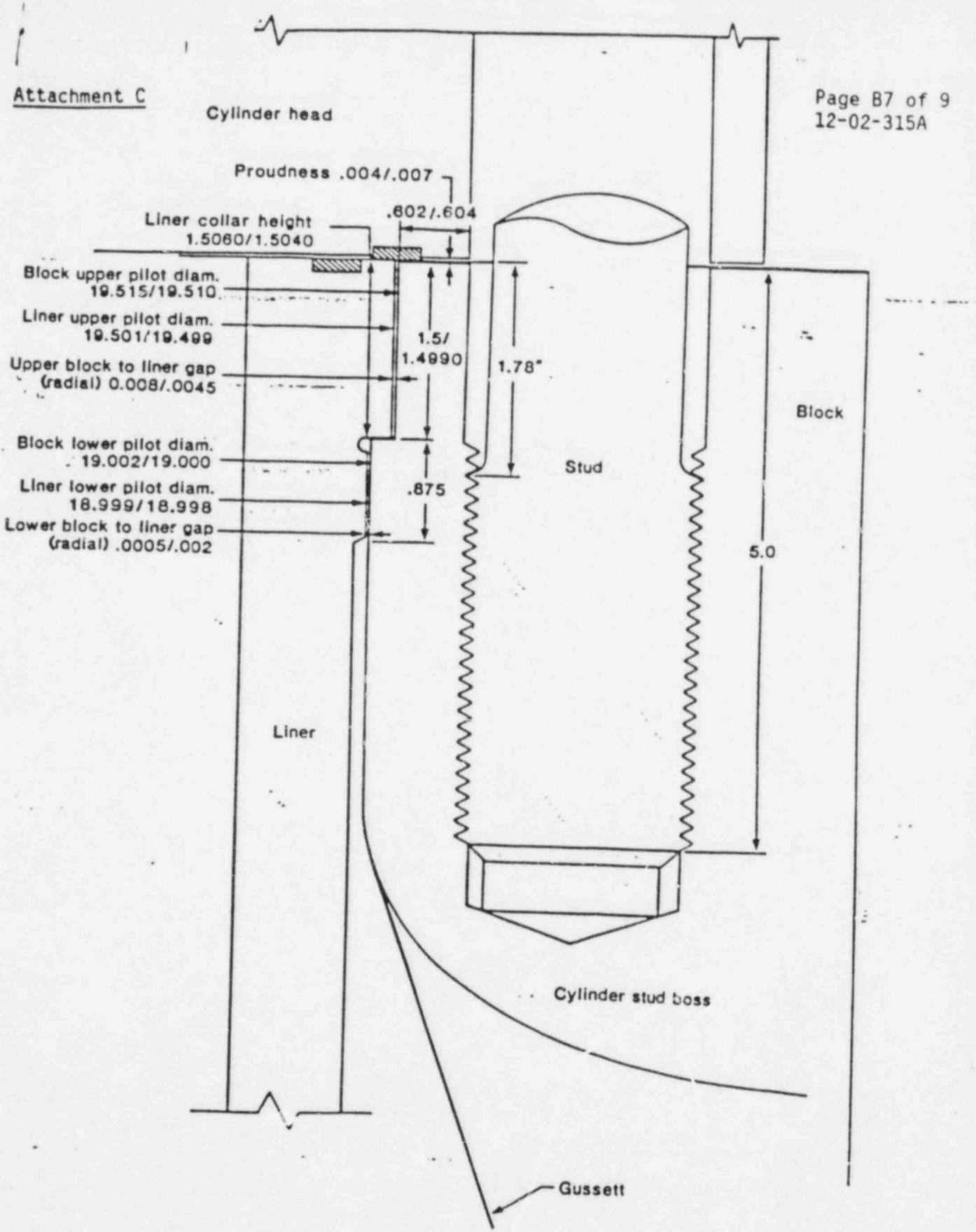


Figure 1-6. Block and liner interface (7/31/68 TDI dimensions). Typical for SNPS EDG101/102 and original EDG103.

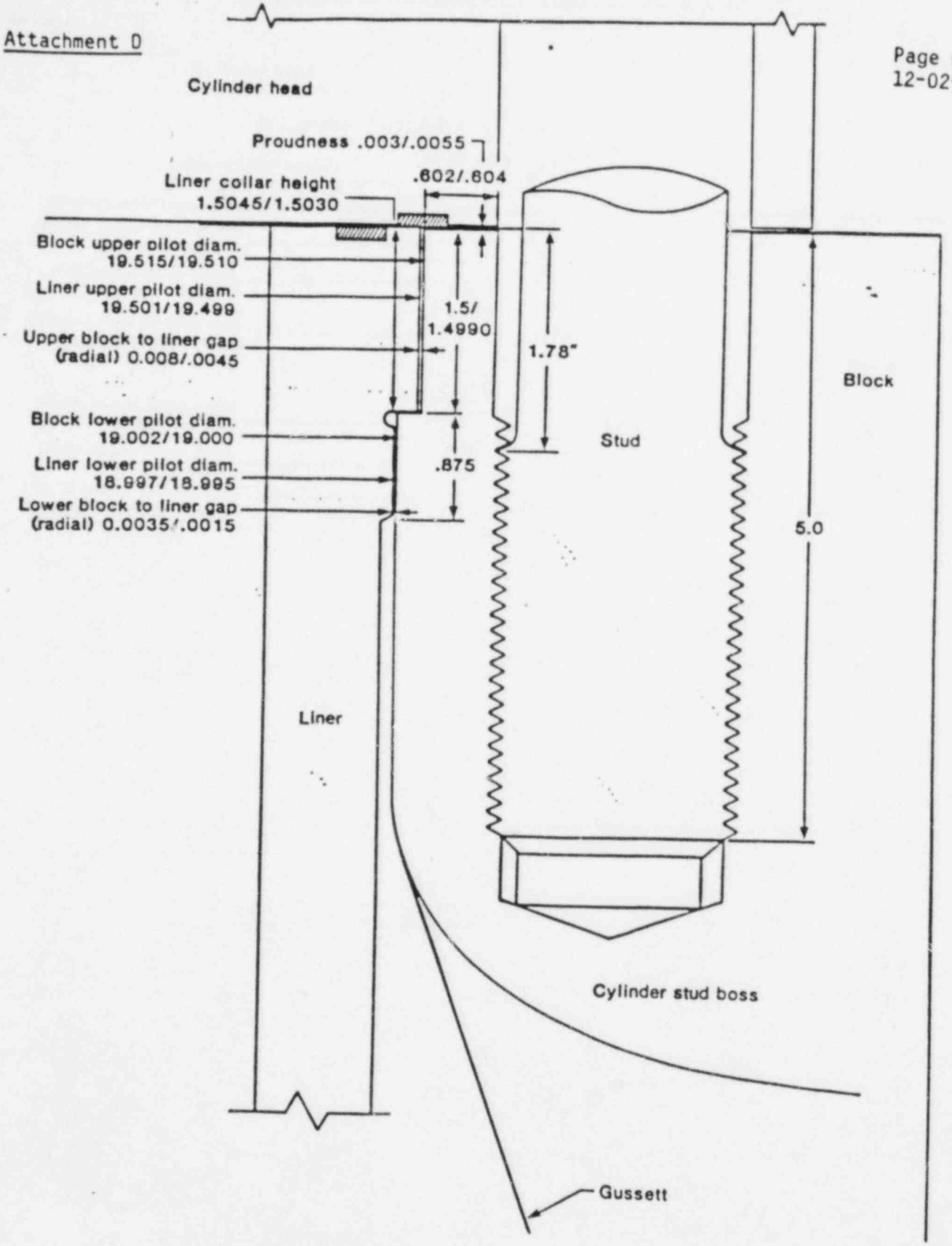


Figure 1-7. Block and liner interface (1/19/78 TDI dimensions).

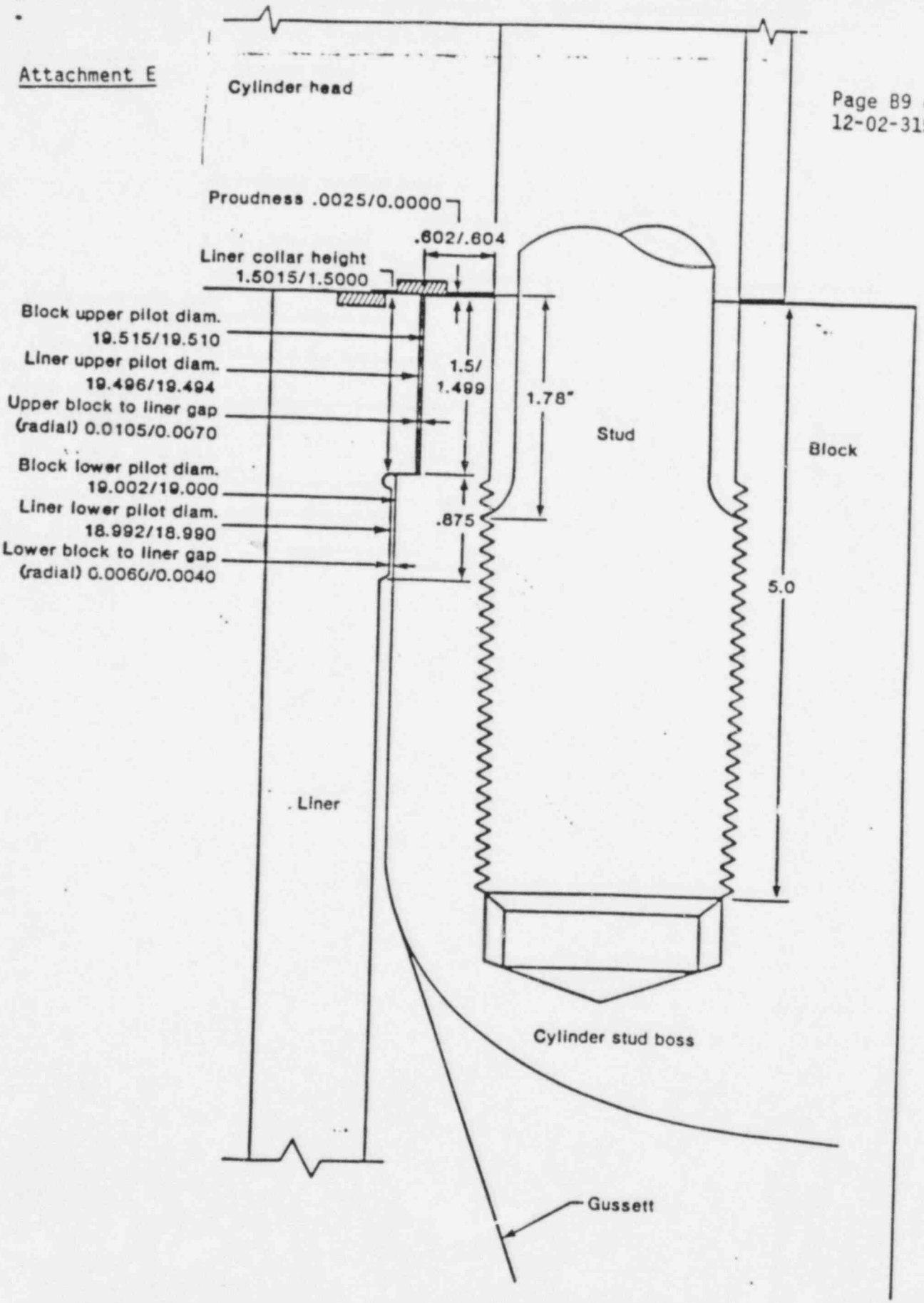


Figure 1-8. Block and liner interface (10/24/83 TDI dimensions).

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-315A

Effective Printout Dates: 11/13/84

COMPONENT TYPE: Cylinder Block

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
Cylinder block repair for corrosion.	SIM 247	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Gasket groove of 7R cylinder was cracked.	Service Report TPC Nuclear Plant No. 3 Maanshan Dec. 9, 1983 (File No. T-45)	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
NON-NUCLEAR		
The forward outboard cylinder block of the starboard main engine of the vessel cracked from the entry of water from the cooling system into the air intake system of the engine.	Letter 4/21/83 J. Blain to W. Busch Complaint C.A. No. H-83-2420 filed U.S. District Ct. 52, p.4; U.S. Salv. Assoc. Rpt. 52-15573, 7/1/82; Amer. Bur. Ship. Rpt. HA-81-2539, 12/16/81; Salv. Assoc. Rpt. CH0830, 4/1/82.	No impact on WNP-1. Reference intercooler report.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
Block cylinder bores were found egg shaped.	Hunton & Williams to C. Seaman 12/29/83; Memo M. Zbinden to R. Ward 1/16/81.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Extensive cracking of cylinder block.	Hunton & Williams to C. Seaman 12/29/83; Memo M. Zbinden to R. Ward 3/13/81.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Final cam tappet could not be placed into position because of deficient cylinder block.	Hunton & Williams to C. Seaman 12/29/83; M. Zbinden to File 4/29/81.	No impact on WNP-1. Isolated initial assembly problem.
Cylinder blocks ordered because previous ones fretted, distorted, and cracked. Head stud holes not machined properly per TDI's spec.	Hunton & Williams to C. Seaman 12/29/83; M. Zbinden to File 4/9/81; M. Zbinden to R. Ward 3/13/81.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
TDI blocks on malaspiner class vessels are structurally stronger although rated less than half of Columbia's HP.	Hunton & Williams to C. Seaman 12/29/83; M. Zbinden to R. Lind 6/17/81.	No impact on WNP-1.
Allegations made that cylinder block has experienced creep and cylinder block is heated during operation in the center and room temperature at the ends.	Hunton & Williams to C. Seaman 12/29/83; G. Trussell to D. Thompson 10/27/81.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
Engine derating will lessen thermal stresses of cylinder block.	SES 123-01, 4/83, pp. 4-6, 4-7	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Observed deformation of cylinder liner block. Counterbore lip of cylinder block boserved to have circumferential cracking.	SES 123-01, 4/83, pp. 3-14, 3-28, 6-3.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Reformation of counterbore lip of cylinder liner block caused by metallic fatigue.	Engine Rebuild Report for Alaska 3/31/81, pp. I, I-10.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WPN-1.
Block deformation from cracks, metallic fatigue creep, overload of counterbore lip, close proximity of cooling water holes, close proximity of head retaining studs, and thread termination for studs level with counterbore depth is causing high stress concentration area.	Engine Rebuild Report for Alaska 3/31/81, pp. I-9, V, V-10, VI, VIII and Summary pp. 26, 27.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Engine crankshaft out of alignment; possibly from engine block misalignment.	Engine Rebuild Report for Alaska 3/31/81, pp. V-10, V-12, VI.	Reference crankshaft Report on WNP-1. No impact on WNP-1.
Reported cracks between heads and liner bores.	Memo from E. Sigrist (TDI) to G.E. Trussell (TDI) dated 11/8/82 (File No. T-10) City of Homestead, Fla.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
Reported cracks between the head stud holes and line bores.	Letter from R. Pratt (TDI) to John Smith City of Homestead, Fla. dated 6/17/82 (File No. T-2) City of Homestead, Fla.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Engine block cracked from improper placing and tightening of head gaskets (April 1979).	Memo from E. Sigrist (TDI) to G.E. Trussell (TDI) dated 11/8/82 (File No. T-10) City of Homestead, Fla.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Several cracks were discovered running from the cylinder cover bolt holes into liner. Cause of cracks not determined.	Letter from R. C. Grindeland (BIEHL) to C. Mathews (TDI) 03/16/81 (File No. T-14).	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Cylinder block fractures caused by the combination of diametral and vertical thermal expansion of the liner, cyclic stress from combustion pressure both radially from the liner and vertically through the head studs, and torque down stress of the studs themselves. Recommendations: cyl. head, studs machined to remove stud load stress, cracks repaired by Metalok technique and diameter of the upper liner collar was reduced by .005 inches.	Letter from M. Lowrey (TDI) to H. Blanding (American Bureau of Shipping) dated 12/30/83 (File No. T-30). Letter from M. Lowrey (TDI) to H. Taylor (American Bureau of Shipping) dated 10/28/83 (File No. T-30). Minutes of meeting between TDI and USS-GLF on 12/20, 21, 1983 (File No. T-30). Letter from R. Bertz (USS-GLF) to A. Barich (TDI) dated 4/7/83 (File No. T-30). Letter from R. Bertz (USS-GLF) to M. Lowrey (TDI) dated 7/14/83 (File No. T-30).	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
Distortion in upper deck and small cracks in cylinder block. New blocks have heavier external walls and interior bulkheads.	Report by George G. Sharp, Inc. "Overview of Reports, Analysis and Recommendations Re-Propulsion Engines M/V Columbia" by July 26, 1983.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Cracks in the engine block at a point between the cylinder head hold-down studs and the cylinder liner bore. These cracks were repaired in Unit 18 but the same type of block cracks have reappeared in both Units 18 and 19 in several stud locations on each.	Letter from A. Muxo-(City of Homestead) to C.S. Mathews and and R.J. Bazzini (TDI) dated 5/31/82 (File No. T-10). Letter from A. Muxo (City of Homestead) to C.S. Mathews dated 12/13/82 (File No. T-10). Letter from J. A. Smith (City of Homestead) to G. E. Trussell (TDI) 06/14/77 (File No. T-10). Comments by City of Homestead, Fla. on the observations of R. A. Pratt and G. E. Trussell tested in the Transamerica Delaval Survey Report, 8/10/82 (File T-10).	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
Cylinder block cracking.	Minutes of meeting between USS Great Lakes Fleet Service, Inc. and TDI dated 4/13/83 (File No. T-46). Telex from G. Trussell (TDI) to R. Bertz (USS-GLF) dated 4/8/83 (File No. T-46). Letter from R. Bertz (USS-GLF) to A Barich (TDI) dated 4/7/83 (File No. T-46). Agenda TDI and USS-GLF dated 4/13/83 (File No. T-46). American Bureau of Shipping Report by D.W. Johnson Report No. DL5702 dated 3/22/83. (File No. T-46).	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Cracks in engine block. Florida.	Letter 5/13/82 from City of Homestead, Fla. to TDI (Oakland and New York Units 18 and 19 (File T-64)	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Piston failed and hit block causing crack. Could drill stop each leg of crack, then stitch up holes with a few supporting stitches along length of crack.	TDI Letter to Metalok International 5/12/81 (File No. T-50), Greg Beshouri (TDI), D. Venning (Metalok Int Assn. Ltd). Enterprise Oak (Geoff King) to Beshouri 5/28/81-2 (File T-50). Photocopy of preliminary report on crack on left cylinder (4th) by G.K. Rao (Bhel). Memo dated 5/11/81 Bob Bailey (Riyadh) to G. King (Oakland) (File T-50).	Isolated incident. Not a design related problem. No impact on WNP-1.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
Engine derating will lessen thermal stresses of cylinder block.	SES 123-01, 4/83, pp. 4-6, 4-7	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Observed deformation of cylinder liner block. Counterbore lip of cylinder block boserved to have circumferential cracking.	SES 123-01, 4/83, pp. 3-14, 3-28, 6-3.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Reformation of counterbore lip of cylinder liner block caused by metallic fatigue.	Engine Rebuild Report for Alaska 3/31/81, pp. I, I-10.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Block deformation from cracks, metallic fatigue creep, overload of counterbore lip, close proximity of cooling water holes, close proximity of head retaining studs, and thread termination for studs level with counterbore depth is causing high stress concentration area.	Engine Rebuild Report for Alaska 3/31/81, pp. I-9, V, V-10, VI, VIII and Summary pp. 26, 27.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.
Engine crankshaft out of alignment; possibly from engine block misalignment.	Engine Rebuild Report for Alaska 3/31/81, pp. V-10, V-12, VI.	Reference crankshaft Report on WNP-1. No impact on WNP-1.
Reported cracks between heads and liner bores.	Memo from E. Sigrist (TDI) to G.E. Trussell (TDI) dated 11/8/82 (File No. T-10) City of Homestead, Fla.	Inspection of block tops at intervals governed by inspection results and accumulated operation will confirm block reliability at WNP-1.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Cylinder Block Liners & Water Manifold - Cylinder Liner

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-315C

TASK DESCRIPTION NO. DR-12-02-315C-0

SNPS GPL NO. 03-315C

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for this component based on review of the lead engine DR/QR reports (Shoreham/Comanche Peak) and the reported applicable industry experience. There is no site experience in the EDG Component Tracking System.

There are no modification recommendations for this component, however, the following is recommended as a maintenance item:

- Inspect the cylinder liners borescopically (visually if the cylinder heads are off) at every refueling outage for signs of progressive wear.

The following Quality inspections as delineated in the CQRC are recommended:

- Verify liner dimensions including bore, length, height, O.D. and shoulder height for all cylinder liners.
- Visually inspect the outside pilot diameter where it contacts the cylinder block on all cylinders.
- Visually inspect all cylinder liners over the zone of piston travel.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Manifold Piping (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-315D

TASK DESCRIPTION NO. DR-12-02-315D-0

SNPS GPL NO. 03-315D

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak)
- A comparison of the jacket water manifold piping for WNP-1 with Comanche Peak.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER JC Kamminga

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Cylinder Block Liners & Water Manifold: Studs

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-315E

TASK DESCRIPTION NO. DR-12-02-315E-0

SNPS GPL NO. 03-315E

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review of this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry experience. There is no site experience for this component in the EDG Component Tracking System.

There are no maintenance recommendations for this component; however, the following change to the installation torque is recommended to lower the stresses in the cylinder block (Ref. 1):

- Lubricate the cylinder head stud blockside threads with engine oil.
- Torque the studs into the block to 80-120 ft-lbs. Use the necessary lockwashers (shims) to obtain a stud free length of 15" ± 1/16". (Caution: Do not use impact type tools to tighten the studs). The free length is measured from the block top to the end of the cylinder head stud. Care should be taken not to further tighten the headstuds during installation of the heads and torquing of the head stud nuts to 3600 ft-lbs.

The following Quality inspections should be performed regardless of the design that is implemented:

- Perform a visual inspection of the head studs for signs of distress (four heads; per engine)
- Determine the material of four studs (material to be AISI 4140/4142) on one engine;
- Determine the hardness of one stud (hardness to be 25-30 Rc) on one engine;
- Verify that the studs are installed with a torque of 80-120 ft-lbs into the block per the above recommendations, all engines.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. TDI Diesel Generator Owners Group letter (OGTP-296-0-.56) cylinder head stud modification and revised installation procedure. File: MTS-4086 (Dated 9/24/84).

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Cylinder Block Liner & Water Manifold - Cylinder Head Nuts

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-315F

TASK DESCRIPTION NO. DR-12-02-315F-0

SNPS GPL NO. 03-315F

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the Comanche Peak and Shoreham DR/QR reports, which establish the acceptability of the cylinder head nuts for their intended purpose.

- A review of site, nuclear and non-nuclear industry experience in the EDG Component Tracking System indicated that there had been no design related failures associated with this component. The cylinder head nuts are identical on all the Owner's Group TDI Diesel Engines (TDI Part No. F-090-021).

The only adverse experience occurred at Shoreham and involved a cracked nut attributed to a forging lap during manufacturing, and did not impair engine operation.

There are no maintenance or modification recommendations for this component.

The following Quality Revalidation inspections should be performed on both engines to ensure component quality:

- Visually examine all nuts for identification markings.

- Verify the proper installation and torquing of the nuts.

- Perform a visual inspection of the nuts for signs of forging laps.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Cylinder Block-Liners and Water Manifold: Seals and Gaskets UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-315G TASK DESCRIPTION NO: DR-12-02-315G-0

SNPS GPL NO. 03-315G CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the applicable industry experience and the lead engine DR/QR reports (Shoreham/Comanche Peak). There is no reported site experience for this component in the EDG Component Tracking System.

A review of the applicable site documentation should be performed to verify that the proper cylinder liner seals (TDI P/N JA-046-008) have been installed in the diesel generators.

There are no maintenance or modification recommendations for this component.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Cylinder Block-Liners and Water Manifold: Seals and Gaskets UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-315G TASK DESCRIPTION NO: DR-12-02-315G-0

SNPS GPL NO. 03-315G CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the applicable industry experience and the lead engine DR/QR reports (Shoreham/Comanche Peak). There is no reported site experience for this component in the EDG Component Tracking System.

A review of the applicable site documentation should be performed to verify that the proper cylinder liner seals (TDI P/N JF-019-000) have been installed in the diesel generators.

There are no maintenance or modification recommendations for this component.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

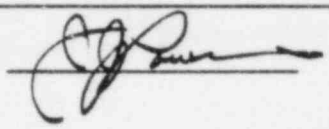
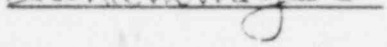
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Cylinder Block Covers: Gaskets & Bolts

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO 02-385B

TASK DESCRIPTION NO. DR-12-02-385B-0

SNPS GPL NO. 03-385B

CLASSIFICATION TYPE C

TASK DESCRIPTIONS

Design review for this component is not required based on a review of the lead engine DR/QR report (Comanche Peak) and the applicable site and industry experience.

There have been cases of fastener failures on the cylinder block covers, however these failures are not attributed to design deficiencies of this component. Based on the lead engine DR/QR report, the recommended torque value of 30 ft-lbs is appropriate and the specified bolting and stud materials (SAE GR 5 and SAE GR 1120 respectively) are acceptable for their intended function of holding the covers onto the cylinder block. Isolated failures can occur when the torque is not applied properly or a lesser grade material is substituted. Barring any deviations as mentioned above the bolting is acceptable for use on the diesel engines.

There are no modification or maintenance recommendations for this component.

The following Quality inspections are recommended to be performed on one engine:

- Verify that the proper torque is applied and the specified material is installed. Plant personnel should review site documentation or perform the necessary inspection to make these determinations.
- Perform a visual inspection to verify that the gaskets are suitable for the environment.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Cadogan PROGRAM MANAGER Kevin T. Fitzpatrick

TDI DIESEL GENERATOR

DESIGN REVIEW AND QUALITY REVALIDATION REPORT

Prepared For

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

WPPSS NUCLEAR PROJECT 1

By

TDI DIESEL GENERATOR OWNERS GROUP

VOLUME 3

How To Use This Report

Tabs in this report identify the following categories:

Turbo, Intake, Intercooler & Exhaust
Lube Oil
Engine Base & Bearing Caps
Crankshaft & Bearings
Cylinder Block, Liners & Water Manifold
Air Start & Barring Device
Connecting rods
Pistons
Camshaft & Valve Train
Idler Gear Assembly & Front Gear Case
Flywheel
Engine Instrumentation & Wiring
Overspeed Trip & Governor
Engine Shutdown & Equipment
Jacket Water
Cylinder Heads & Valves
Fuel Oil Injection
Generator
Control Panel Assembly
Engine & Auxiliary Sub-Base & Foundation Bolts

These categories have been defined to allow the reader to review a complete diesel generator subsystem in a convenient manner.

Within each category tabs identify WPPSS Nuclear Project 1 specific component numbers.

A given component report can be found by:

a) If the component number is known - use the alpha - numberic index which identifies the volume number and category in which the component report is located.

b) If only the component name is known - Section 3.2 may be used as a cross-reference to find the volume number where the component report may be found.

Some reports address more than one component. a tab is provided for each component. However, some components are combined under one report Slip sheets are provided where required to reference back to the appropriate tab. Some components required more than one report. These are identified by the abbreviation LB-Large Bore and SB-Small Bore on the component number tabs.

For the purpose of writing this report, the WPPSS Nuclear Project 1 engines were designated as A and B. The relation of these designations to other plant numbers associated with the engines is given in the table below.

Report Designation	Plant Mark Number	Engine Serial Number
A	EDG-DG-1-B	75084
B	EDG-DG-2-A	75085

Component Number	Component Description	Category	Volume No.
F-068	Intercooler	Turbo, Intake Intrclr. & Exhaust	2
MP022/23	Turbocharger	Turbo, Intake, Intrclr. & Exhaust	2
SE-025	Lube Oil Full Pressure Strainer	Lube Oil	2
00-420	Lube Oil Pressure Regulating Valve	Lube Oil	2
00-442A	Starting Air Distributor: Distributor Assembly	Air Start & Barring Device	3
00-442B	Starting Air Distributor: Tubing, Fittings, Gaskets	Air Start & Barring Device	3
00-621A	Fuel Oil Drip Tank Assembly	Fuel Oil Injection	4
02-CFR	Turbocharger Thrust Bearing Lubrication System	Turbo, Intake, Intrclr. & Exhaust	2
02-305A	Base and Bearing Caps: Base Assembly	Engine Base & Bearing Caps	2
02-305C	Base and Bearing Caps: Main Bearing Studs & Nuts	Engine Base & Bearing Caps	2
02-305D	Base and Bearing Caps: Main Bearing Caps	Engine Base & Bearing Caps	2
02-307A	Lube Oil Fittings: Internal - Headers	Lube Oil	2
02-307B	Lube Oil Fittings: Internal - Tubing & Fittings	Lube Oil	2
02-307D	Lube Oil Fittings Internal: Supports	Lube Oil	2
02-310A	Crankshaft	Crankshaft & Bearings	2

Component Number	Component Description	Category	Volume No.
02-525B	Barring Device - Pneumatic: Regulator Valve/Shutoff Valve	Air Start & Barring Device	3
02-525D	Barring Device - Pneumatic: Mounting Bracket/Supports	Air Start & Barring Device	3
02-540A	Lube Oil Sump with Strainer Assembly and Mounting Hardware	Lube Oil	2
02-540B	Lube Oil Sump Tank: Misc. Fittings, Gaskets, Pipe & Bolting Material, Valves	Lube Oil	2
02-540C	Lube Oil Sump Tank: Mounting Hardware	Lube Oil	2
02-550	Foundation Bolts: Anchor Bolts, Misc. Hardware	Engine & Aux. Sub Base & Foundation Bolts	4
02-630A	Pyrometer Conduit Assembly: Conduit	Engine Instrumentation & Wiring	3
02-630B	Pyrometer Conduit Assembly: Conduit Fittings	Engine Instrumentation & Wiring	3
02-630C	Pyrometer Conduit Assembly: Support	Engine Instrumentation & Wiring	3
02-630D	Pyrometer Conduit Assembly: Thermocouples	Engine Instumentation & Wiring	3
02-688A	Engine & Aux Module Wiring Material- Conduit & Fittings; Pyrometer Assembly - Conduit, Fitting, Supports	Engine Instrumentation & Wiring	3

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Starting Air Distributor: Distributor Assembly

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 00-442A

TASK DESCRIPTION NO. DR-12-00-442A-0

SNPS GPL NO. 03-442A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for this component, based on the Comanche Peak lead engine DR/QR report, which establishes the acceptability of the distributor assembly. The parts under review are the same as those of the lead engine.

A review of the EDG Component Tracking System indicates no new significant applicable industry or site experience.

In addition to the normal maintenance tasks of water removal and filter replacement for the starting air system, the following maintenance recommendation from the lead engine DR/QR report should be implemented:

- Perform an inspection of the poppet valves and cams on all engines during refueling outages, to assess the degree of wear.

Based on a recent Grand Gulf site experience in which the starting air manifold vent became obstructed, the additional maintenance item listed below is recommended:

- Maintain surveillance inspections to assure that the starting air manifold vent remains open and effective.

There are no modification recommendations for this component.

The following Quality inspections are recommended to be performed on engines 1A and 1B:

- Verify the proper timing of the air start distributor as described in the TDI Manual.

- After verifying the correct timing of each starting air distributor, as described in the TDI Manual, evaluation of wear on the cam and valve contacts should be performed as follows:

  a. Remove the distributor from the engine.

  b. Visually inspect the wear marks on the cam lobes.

Note the position and orientation of the lube oil jet. Oil flow from the jet should cover the wear mark region on the cam lobe.

c. Visually inspect the wear marks on the end of each valve spool where it slides on the cam. Measure the average diameter of the "flat" worn area on the end of each spool to the nearest 1/64-inch. If the largest of these measurements is more than 1.5 times the smallest, an engineering evaluation of the observed wear should be performed and a superficial hardness measurement should be made on the end "wear flat" of each valve spool. If the hardness of any spool end is significantly below 30 Rc, it should be replaced.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

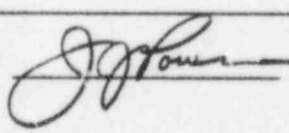
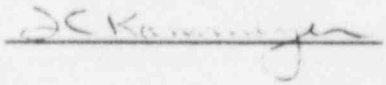
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

TDI OWNERS GROUP

for

WPPSS NUCLEAR PROJECT 1

Starting Air Distributor - Tubing, Fittings and Gaskets

Component Part No.: 00-442B

This component number has been deleted. All Air Distributor Tubing is addressed under component numbers 02-441A and C and 02-307B.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Air Start Valves UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-359 TASK DESCRIPTION NO. DR-12-02-359-0

SNPS GPL NO. 03-359 CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience except that previously addressed in the lead engine reports. Site experience was related to length of capscrews (Ref. TDI SIM 360, below).
- A review of the lead engine DR/QR reports (Shoreham and Comanche Peak).
- Similarity between WNP-1 and lead engine components.

The following maintenance recommendations from the lead engine DR/QR report should be implemented:

- Remove, inspect and, if necessary, clean the air start valves during every refueling outage. The inspection should include inspection of the piston/cap and guide/housing sliding surfaces to evaluate severity of wear and corrosion present. This recommendation is based on discussions with TDI.
- Ensure that the dryer between the compressor after cooler and air receiver is functioning properly by blowing down the air receivers daily and noting any moisture content. Appropriate action should be taken if excessive moisture is noted.

The following modifications should be implemented:

- TDI SIM 329 - Cooper Valve-To-Head Gasket in lieu of Steel Gasket.
- TDI SIM 360 - Replace/Shorten Capscrews; Torque/Retorque Bolts to 150 ft-lbs.

The following Quality inspections have not been performed to date and are recommended for all station engines:

TASK DESCRIPTIONS (continued)

- Perform a visual inspection to verify that adequate seating exists between the valve and valve ring.
- Perform a visual inspection to verify that no carbon deposits exist on the valve internals.
- Verify the hot torque values for the hold down capscrews.
- Perform a dimensional check of the hold down capscrews.
- Perform a material comparator test on the hold down capscrews (sample basis).
- Perform a superficial hardness test on the hold down capscrews (sample basis).

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

STARTING AIR MANIFOLD: PIPING, TUBING, AND FITTINGS
(LARGE BORE SCOPE ONLY)
COMPONENT PART NO. 02-441A

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the structural adequacy of the starting air manifold piping for the effects of normal operating and earthquake loadings.

The primary function of the starting air manifold piping is to provide adequate starting air from the off-skid supply piping to each engine cylinder.

The scope of piping embraced by this report includes the large bore (greater than 2-inch diameter) piping components as noted on the as-built information obtained during Impell field verification (Ref. 1), plus small bore piping, which was included because of the configuration.

Piping components are defined as piping spool pieces, elbows, tees, flanges, Dresser couplings, and the interconnecting welds. This scope is uniquely defined in terms of Transamerica Delaval, Inc. (TDI) part numbers in Reference 1.

II OBJECTIVE

The objective of this review was to verify the adequacy of the subject piping components for normal operating and earthquake loadings.

III METHODOLOGY

The evaluation of the piping is performed in accordance with the philosophy and intent of the ANSI B.31.1 Power Piping Code. Towards this end, a criteria document was developed, "Design Criteria for Diesel Generator Large Diameter Piping for WNP-1," which describes the background and provides the techniques for evaluating the subject piping. These criteria are presented in their entirety in Reference 2.

Quality Revalidation Checklist results were reviewed for acceptability.

The TDI Emergency Diesel Generator Component Tracking System was reviewed for the WNP-1 site, nuclear, and non-nuclear industry experience.

IV RESULTS AND CONCLUSIONS

All piping stresses were within the design allowables specified by the ANSI B31.1 Power Piping Code.

With respect to the Dresser couplings, Impell evaluated the couplings against the manufacturer's selection and service requirements. These include the design service conditions, relative end displacements from both translation and rotation of the joined pipes, and shelf and service life. The movements at the Dresser couplings are within the manufacturer's end movement requirements (Ref. 3). There are no service life constraints (Ref. 4) because this style of coupling has no significant history of failure. Shelf life (Ref. 4) is unlimited as long as the gaskets remain packaged and protected from the elements (light, water, etc.). The couplings are adequate with respect to manufacturer's service condition limits.

Support modifications were effected in order to provide stiffer load paths and to relieve thermal restraint in certain directions by partial support removal through bolt hole elongations. The support modifications are summarized in Reference 5.

Historical corrosion data for carbon steel starting air systems was not available. However, the subject starting air piping and interconnecting welds have a limiting wall thickness of 5.15 times that required (Ref. 2), which should be sufficient margin against corrosion.

All pipe loads on the engine were tabulated and issued for evaluation. These evaluations were performed as part of the development of reports for component Nos. 02-315A and 02-441B.

There are no Quality Revalidation Checklist results or TERs associated with this component.

Based on the above review, it is concluded that the subject piping components, with the above recommended modifications, are adequate for their intended design function at WNP-1.

V REFERENCES

1. "Supporting Calculations for the Evaluation of WNP-1 Diesel Generator Large Diameter Piping and Support," Impell Report No. 02-0630-1306, Rev. 0, December 1984.

2. "Design Criteria for Diesel Generator Large Diameter Piping for WNP-1," Impell Report No. 02-0630-1305, Rev. 0, December 1984. This is included in Appendix III of the final DR/QR report.

3. Dresser Pipe Couplings, Pipe Fittings, and Pipe Repair Products Catalog, No. 63.

4. Telecon between A. Palumbo (Impell) and M. Riley (Dresser Manufacturing Co.), dated June 5, 1984.

5. Letter from R. Markovich/G. Shears (Impell) to J. Kammeyer (SWEC)," Required Modification for Validation of Impell's Design Review for Component No. 02-441A-WNP," dated December 13, 1984.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Starting Air Manifold: Piping (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-441A

TASK DESCRIPTION NO. DR-12-02-441A-0

SNPS GPL NO. 03-441A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Evaluate structural integrity of the starting air manifold piping spool pieces and fittings, for the effects of normal operating and earthquake loadings by (a) comparison to previous analyses, (b) review of previous analyses, (c) review of previous qualification documentation, and/or (d) actual performance of stress evaluation in accordance with the intent and philosophy of ANSI B31.1 Power Piping and Impell Design Criteria.

Review information provided on TERs.

PRIMARY FUNCTION

Provide adequate starting air from off-skid supply piping to each engine cylinder.

ATTRIBUTE TO BE VERIFIED

Structural integrity of large bore (greater than 2 in. dia.) piping spool pieces and fittings to withstand the effects of normal operating and earthquake loadings.

SPECIFIED STANDARDS

None

REFERENCES

"Design Criteria for Diesel Generator Large Diameter Piping for WNP-1," Impell Report No. 02-0630-1305, Rev. 0, December 1984.

DOCUMENTATION REQUIRED

Verified piping isometric, material specification, size and schedule, design parameters (temp., pressure), contents, insulation, fitting and gasket design parameters.

GROUP CHAIRPERSON John Costagna PROGRAM MANAGER Kevin T. Fitzpatrick

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Starting Air Manifold - Piping, Tubing & Fittings

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-441A

REV. NO. 1

SNPS GPL NO. 03-441A

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

2. Obtain sufficient data to support the Design Review effort. This may be accomplished by developing quality verified as-builts in accordance with DG-7, or by the Design Group performing a field walkdown.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

2. Information necessary for the design review effort

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package
2. Review of detailed information by the Design Group

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52
2. Procedure DG-7

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet
2. Quality verified as-built isometric drawings for the piping, tubing and fitting if available from the owner.

Engine B

Same as Engine A

GROUP CHAIRPERSON Steve K Short PROGRAM MANAGER JC Kammeyer

COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.

2. The Design Group will be responsible for closing out this item. This can be done per procedure DG-7 or by performance of an engineering walkdown by the Design Group.

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON Nitin A. Salvi PROGRAM MANAGER JC Kammeyer

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-441A

Effective Printout Dates:
Industry - 12/12/84
WNP-1 site - 12/13/84

COMPONENT TYPE: Starting Air Manifold: Piping, Tubing and Fittings

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
Manifold purge from turbocharger exhaust to prevent moisture/ corrosion.	TDI SIM 323	TDI SIM #323 is concerned with purging moisture from the starting air manifold. Historical data on corrosion in carbon steel starting air lines was not available. However, Impell evaluation of subject piping determined that the nominal available pipe wall thickness was 5.15 times the minimum required. Therefore, there is adequate pipe margin against corrosion in the subject lines. TDI SIM #323 is concerned mainly with fouling of starting air valves from corrosion. Note: TDI SIM 323 will not be installed at WNP-1.
NON-NUCLEAR		
None		

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-441A

Effective Printout Dates:
Industry - 12/12/84
WNP-1 site - 12/13/84

COMPONENT TYPE: Starting Air Manifold: Piping, Tubing and Fittings

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
Manifold purge from turbocharger exhaust to prevent moisture/ corrosion.	TDI SIM 323	TDI SIM #323 is concerned with purging moisture from the starting air manifold. Historical data on corrosion in carbon steel starting air lines was not available. However, Impell evaluation of subject piping determined that the nominal available pipe wall thickness was 5.15 times the minimum required. Therefore, there is adequate pipe margin against corrosion in the subject lines. TDI SIM #323 is concerned mainly with fouling of starting air valves from corrosion.
NON-NUCLEAR		
None		

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Starting Air Manifold: Piping, Tubing and Fittings (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-441A

TASK DESCRIPTION NO. DR-12-02-441A-0

SNPS GPL NO. 03-441A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR reports (Comanche Peak, Grand Gulf and Catawba) and the applicable industry experience from the EDG Component Tracking System. There is no site experience for this component in the Component Tracking System.

The following maintenance recommendation from the lead engine DR/QR report should be implemented monthly:

- Ensure that the starting air manifold vent is open and effective.

A field walkdown was performed at WNP-1 in accordance with the small bore piping criteria document (Ref. 1). However, a review of this component in its entirety was not possible since portions of this component were not installed at the time of the walkdown. Therefore, component acceptability and any subsequent recommendations for the uninstalled portions shall be based upon the lead engine reports (Comanche Peak, Grand Gulf, and Catawba). It is concluded that this component will perform its intended function at WNP-1 under all operating and earthquake loadings provided that supports are added/modified as indicated in DR/QR Report 02-441C.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTES TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John Cudon PROGRAM MANAGER K.T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Starting Air Manifold: Valves, Strainers & Filters
UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-441B
TASK DESCRIPTION NO. DR-12-02-441B-0

SNPS GPL NO. 03-441B
CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no applicable industry experience other than that previously addressed in the lead engine report. There was no site experience in the Component Tracking System.
- A review of the lead engine DR/QR reports (Shoreham & Comanche Peak).
- The components used at WNP-1 have been used on the lead engines with the exception of one check valve (Nupro, Model SS-4C-1). There is no site experience with this valve.

The following maintenance recommendations from the applicable lead engine reports should be implemented at WNP-1:

- The starting air admission valve and shuttle valve have "O" rings and/or a screened fitting, susceptible to wear and fouling. The "O" rings should be replaced and the screened fitting cleaned, every outage.
- The starting air valves should be disassembled, cleaned, inspected, lubricated and reassembled to prevent fouling. They should be tested to assure leak tightness, every outage.
- Inspect for tightness of fittings and bolts and apply locking compound, as-required, during reassembly of component, every outage.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Starting Air Manifold: Valves, Strainers & Filters

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-441B

TASK DESCRIPTION NO. DR-12-02-441B-0

SNPS GPL NO. 03-441B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no applicable industry experience other than that previously addressed in the lead engine report. There was no site experience in the Component Tracking System.
- A review of the lead engine DR/QR reports (Shoreham & Comanche Peak).
- The components used at WNP-1 have been used on the lead engines with the exception of one check valve (Nupro, Model SS-4C-1). There is no site experience with this valve.

In addition, review of TDI Instruction Manual Volume II, Group Parts List 03-441 indicates WNP-1 engines have a starting air manifold purge line installed on the intake manifold (TDI SIM 323). This provides a method of drying and purging the starting air manifold, thereby increasing the reliability of the starting air valves.

The following maintenance recommendations from the applicable lead engine reports should be implemented at WNP-1:

- The starting air admission valve and shuttle valve have "O" rings and/or a screened fitting, susceptible to wear and fouling. The "O" rings should be replaced and the screened fitting cleaned, every outage.
- The starting air valves should be disassembled, cleaned, inspected, lubricated and reassembled to prevent fouling. They should be tested to assure leak tightness, every outage.
- Inspect for tightness of fittings and bolts and apply locking compound, as-required, during reassembly of component, every outage.

TASK DESCRIPTION (continued)

- The filter element should be inspected and cleaned/replaced on a monthly basis. In accordance with the manufacturer's recommendation, the filter should be changed before the maximum pressure drop of 25 psid.

- The strainer is recommended to be blown down daily and cleaned and inspected monthly. If the strainer is excessively dirty, the frequency of cleaning and inspecting should be increased.

The following modification from the lead engine DR/QR report should be made:

- In accordance with TDI recommendation free flowing drains should be added to the air distributor filter. This is a design improvement that will help maintain a cleaner supply of starting air.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Starting Air Manifold: Supports (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-441C

TASK DESCRIPTION NO. DR-12-02-441C-0

SNPS GPL NO. 03-441C

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak)

Based on previous experience, supports appear to be adequate provided that the corresponding piping component no. 02-441A, does not mandate modifications. If the piping analysis warrants modifications to the supports, these modifications will be addressed in the DR/QR report for component no. 02-441A.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

STARTING AIR MANIFOLD - SUPPORTS
(SMALL BORE SCOPE ONLY)
COMPONENT PART NO. 02-441C

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the structural adequacy of the starting air manifold tubing supports to withstand the effects of normal operating and earthquake loadings. The primary function of these supports is to provide adequate restraint of the starting air manifold tubing components.

II OBJECTIVE

The objective of this review was to perform an engineering evaluation of the tubing supports to assure that the component will perform its intended design function during normal operating and earthquake loadings.

III METHODOLOGY

In order to meet the stated objective, the following methods were used:

- The TDI Emergency Diesel Generator Component Tracking System was reviewed for the WNP-1 site, nuclear and non-nuclear industry experience. See Appendix C for results.
- The Quality Revalidation Checklist results were reviewed for acceptability.
- Both engines were partially assembled at the time of site inspection. This component was evaluated using actual walkdown information and by comparison to the Comanche Peak lead engine report.

Refer to the review procedures as described in Reference 1 for a detailed methodology of this evaluation.

IV RESULTS AND CONCLUSIONS

The tubing supports, as defined by this Component Design Review, have been evaluated in accordance with Reference 1 and have been found acceptable with modifications.

There are no Quality Revalidation Checklist results or TERs associated with this component.

Based on the above review and information contained in Reference 2, it is concluded that the tubing supports will perform their intended design function at WNP-1 under all normal operating and earthquake loadings with the provision that the following recommended modifications be implemented as detailed in Reference 3:

Engines A and B

Distributor Tubing to Air Start Valves in Cylinder Heads

- The existing tubing spacers across the generator face of the engine should be modified by the addition of cover plates secured to the engine. Additional two-directional restraints should be added as required to ensure the 4-foot 0-inch maximum span lengths are not exceeded.

Engine B

Starting Air to Distributors

- One two-directional restraint in each riser of the air start tubing on the left bank should be modified to a three-directional restraint to provide vertical support.

In order to support the tubing of component 02-441A, it is recommended that the following supports be added:

Engines A and B

Combustion Air Purge Lines

- The ¼ inch tubing from the air start headers to the combustion air manifold (not installed) should have two-directional restraints at 4-foot 0-inch maximum span lengths. Location of the restraints shall allow for thermal flexibility by providing a 6-inch minimum offset around bends.

Engine A

Starting Air To Distributors

- The tubing from the right and left bank headers to the distributors should have restraints added or moved so that the restraints are located similar to Engine B. In addition, three-directional restraints should be added as close as practical to each side of the filters because of the different style filters used on Engine A. No restraints should be in contact with or attached to the filter cartridges.

Starting Air Manifold Drain Lines

- The ¼-inch tubing drains from the air start headers are not installed. The installation, routing and restraint locations should be similar to Engine B.

Engine B

Air Supply To Governor Servo-Booster

- A two-directional restraint should be added in the riser approximately 18 inches from the air start headers on both sides of the engine.

Distributor Tubing To Air Start Valves In Cylinder Heads

- Tubing clips should be installed in the risers leading to the cylinder heads at approximately mid-span similar to Engine A locations.

Starting Air Distributors

- Two-directional restraints should be added to the ½-inch tubing from the right bank air header to the filter in the following locations:
  - In the riser approximately 18 inches below the air start headers.
  - In the lower horizontal run approximately 12 inches from the riser.
  - In the lower horizontal run approximately 6 inches from the hairpin return into the filter.

The filter cartridges on both sides of the engine should be restrained laterally with a 3/8 inch U-bolt. The mounting bracket for the filter should be rigidly attached to the engine.

V REFERENCES

1. "Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 0.

2. Stone & Webster Calculation number 11600.60-NP(B)-1201-XH

3. Memo No. 6596 from C. Malovrh/SWEC to J. Kammeyer/SWEC dated 12/21/84.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Starting Air Manifold - Tubing Supports (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-441C

TASK DESCRIPTION NO. DR-12-02-441C-0

SNPS GPL NO. 03-441C

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Perform an engineering review of the tubing supports to provide additional assurances that the component will perform its intended design function during normal operating and earthquake loading.

PRIMARY FUNCTION

Provide adequate restraint to the starting air manifold tubing components.

ATTRIBUTES TO BE VERIFIED

Structural adequacy of the tubing supports due to the effects of normal operating and earthquake loadings.

SPECIFIED STANDARDS

IEEE 387; ANSI B31.1,"Power Piping"

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group" Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Delaval design documentation (specifications, calculations, drawings, etc.). In lieu of information from Delaval, the following information is required: verified support sketches and piping isometrics, material specifications, pipe size and schedule, and operating parameters (pressure, temperature, load combinations).

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Starting Air Manifold - Supports

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-441C

REV. NO. 2

SNPS GPL NO. 03-441C

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

2. Obtain sufficient data to support the design review effort. This may be accomplished by developing quality verified as-builts in accordance with Procedure DG-7, or by the Design Group performing a field walkdown.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

2. Information necessary for the design review effort

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package

2. Review of detailed information by the Design Group

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52

2. Procedure DG-7

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet

2. Quality verified as-built isometric drawings for the supports if available from the Owner.

Engine B

Same as Engine A.

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.

2. The Design Group will be responsible for closing out this item. This can be done per Procedure DG-7 or by performance of an engineering walkdown by the Design Group.

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON John A. Scott PROGRAM MANAGER J C Kennedy

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-441C

Effective Printout Date: 11/30/84

COMPONENT TYPE: Starting Air Manifold - Supports

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
None		
NON-NUCLEAR		
None		

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Barring Device-Pneumatic: Regulator Valve, Shutoff Valve

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-525B

TASK DESCRIPTION NO. DR-12-02-525B-0

SNPS GPL NO. 03-525B

CLASSIFICATION TYPE C

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR report (Shoreham).
- The barring device is used during maintenance operations only. Both regulators are supplied by C.A. Norgren.

The following maintenance recommendations from the lead engine DR/QR report should be implemented:

- Daily draining of the air filter while the barring device is in use.
- Replacement of elastomeric parts in the pneumatic regulator every 5 years.

There are no modifications required for this component, based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John Cooley PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Skid Base - Starting Air Equipment

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-835A

TASK DESCRIPTION NO. DR-12-02-835A-0

SNPS GPL NO. 03-835A

CLASSIFICATION TYPE C

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated no significant applicable industry or site experience.
- Each diesel generator set has two air receiver tanks and an air supply system. Each air receiver tank is capable of providing air for 5 starts without operation of the compressors (Ref. 2). The tanks are not skid mounted (Ref. 1) and are connected by a support strut. The tanks are protected from gross air leakage in the skid mounted components by check valves (Ref. 1). Thus failures in skid components are primarily maintenance concerns and will not affect safety related starts.
- A review of the lead engine report (Comanche Peak) indicated no design deficiencies relating to TDI design of this component.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. TDI drawing no. 101161, "Air Start Equipment and Piping"

2. Specification 9779-53, Rev. 17, 11-17-81 "Diesel Generators" for the WPPSS Nuclear Project Nos. 1 & 4, Page 15A-20

3. Seismic Qualification Report on Washington Public Power Supply System Nuclear Projects No. 1 and 4 prepared by Structural Dynamics Research Corporation for Delaval Turbine Inc., Project Number 3815, Section III.12,

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DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Coologan PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Starting Air Tank

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-835F

TASK DESCRIPTION NO. DR-12-02-835F-0

SNPS GPL NO. 10-111

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review of this component for WNP-1 is not required based on following:

- A review of EDG Component Tracking System indicated no significant applicable industry or site experience.
- The tank is similar in configuration to the Grand Gulf tank but is qualified to ASME III (Ref. 4) instead of ASME VIII, and has a thickness of ½-inch (instead of 5/8-inch). The design and stresses for the Grand Gulf tank have been reviewed and found acceptable (Ref. 3).
- Each engine at WNP-1 is equipped with two starting air tanks for redundancy. The two tanks are installed close to one another and are strapped together at the top with a brace (pipe) leading from the strap to the air start skid.
- The SDRC Seismic Analysis Report (Ref. 2) considered stresses due to pressure, deadweight, seismic and nozzle loads. All stresses were found acceptable.
- This tank is manufactured by Thermxchanger Inc., whose previous work on other vessels has been found to be acceptable.

Special maintenance requirements identified in the lead engine design reviews (Comanche Peak and Shoreham), apply to WNP-1. The drain valve or float trap should be monitored daily and excessive amounts of moisture should be reported to determine the cause.

No modification requirements are applicable based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. United Engineers & Constructors Spec. No. 9779-53, "Diesel Generators Contract No. 53, Quality Class I, for Washington Power Supply System, 300 George Washington Way, Richland, Washington," Rev. 17, 11/17/81.

2. Seismic Qualification Report of TDI Diesel Generator Sets, Serial No. 75084/5 for Washington Public Power Supply System," SDRC Project No. 3815, dated 11/18/78.

3. Stone & Webster Calculation No. 11600.60-NM(B)-002-CZC-007, "Review Calculations for the Starting Air Tank," for Grand Gulf, Rev. 0.

4. TDI Purchased Material Specification: "Starting Air Tanks" for part no. 75084-108, dated 11/3/80.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadoga PROGRAM MANAGER K. Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Air Start Tank Relief Valves

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-835H

TASK DESCRIPTION NO. DR-12-02-835H-0

SNPS GPL NO. 03-800C

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR report (Comanche Peak).
- Both plants air start tank relief valves are Crosby Model JMBU.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Conlon PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Starting Air Float Trap

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-835J

TASK DESCRIPTION NO. DR-12-02-835J-0

SNPS GPL NO. 99-835C

CLASSIFICATION TYPE C

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no industry or site experience.
- A review of the lead engine DR/QR report (Comanche Peak)
- Both Comanche Peak and WNP-1 float traps are Armstrong Model 32-LD.

The following maintenance from the lead engine DR/QR report should be implemented:

- Verify operability daily
- Disassemble and clean at each outage

There are no modifications for this component based on a review of the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Calogero PROGRAM MANAGER J C Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Connecting Rods: Rods and Bushings UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-340A TASK DESCRIPTION NO. DR-12-02-340A-0

SNPS GPL NO. 03-340A CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no site experience, and no significant applicable nuclear or non-nuclear industry experience not previously addressed.
- A review of the Comanche Peak and Shoreham DR/QR reports, which establish the acceptability of the connecting rod assembly for its intended purpose.
- The applicable engine dimensions and operating parameters at WNP-1 are identical or very similar to those for the same component at Comanche Peak (lead engine).

Maintenance recommendations based on the Comanche Peak DR/QR report to ensure proper performance under normal operating conditions are as follows:

- Perform a clearance check at the link rod/link pin connection in accordance with TDI-SIM #349 to verify the zero clearance when the specified bolt torque of 1050 ft-lbs is applied. This recommendation is required one time only.
- At the first 5 year overhaul, visually inspect the rack teeth surfaces for signs of fretting.

The following Quality revalidation inspection recommendations are made to ensure proper component quality and performance, and should be performed on both diesel engines, as noted:

Engine A

- Perform a material comparator test on the connecting rods. Use spares if available.
- Perform a hardness test on the connecting rods. Use spares if available.

TASK DESCRIPTIONS (continued)

- Perform eddy current test on all rod box female threads.
- Perform a magnetic particle test on all connecting rod bolts.
- Perform a visual inspection of all connecting rod bolt washers and contact surfaces for signs of galling.
- Verify that the torque loads on all connecting rod bolts are in accordance with the latest TDI recommended values.
- Perform a liquid penetrant test on the surface of the internal diameter of all the wrist pin bushings.
- Perform a visual inspection of the rack teeth connection for signs of fretting and prior to reassembly inspect mating surfaces to verify that the minimum manufacturers recommended percent contact surface is available.
- Perform a clearance check of the link rods and link pins for proper alignment.

Engine B

- Perform an eddy current test on all rod box female threads.
- Perform a magnetic particle test on all connecting rod bolts.
- Perform a visual inspection on all connecting rod bolts to assure that they are in accordance with the latest TDI recommended values.
- Verify that the torque loads on all the connecting rod bolts are in accordance with the latest TDI recommended values.
- Perform a liquid penetrant test on the surface of the internal diameter of all wrist pin bushings.
- Perform a visual inspection of the rack teeth connection for signs of fretting, and prior to reassembly, inspect mating surfaces to verify that the minimum manufacturers recommended percent contact surface is available.
- Perform a clearance check of the link rods and link pins for proper alignment.

There are no modification recommendations for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

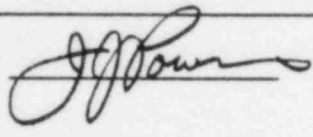
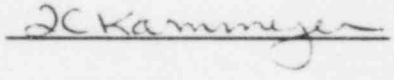
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Connecting Rod Bearing Shells	UTILITY Washington Public Power Supply System
GROUP PARTS LIST NO. 02-340B	TASK DESCRIPTION NO. DR-12-02-340B-0
SNPS GPL NO. 03-340B	CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the Comanche Peak and Shoreham DR/QR reports, which establish the acceptability of the bearing shells for their intended purpose.
- The applicable engine dimensions and operating parameters at WNP-1 are identical or very similar to those for the same component at Comanche Peak (lead engine).
- A review of the EDG Component Tracking System indicated that there was no site experience and no significant applicable nuclear or non-nuclear industry experience.

Maintenance recommendations based on the Comanche Peak DR/QR report to ensure proper performance under normal operating conditions are as follows:

- Inspect and measure the connecting rod bearing shells to verify lube oil maintenance which affects wear rate. The visual and dimensional inspection of the bearing shells should be conducted at the fuel outage which precedes 500 hours of operation by at least the sum of hours of operation in a LOOP/LOCA event plus the expected hours of operation between outages.
- Perform an X-ray examination on all bearing shells using a procedure with sufficient resolution to implement recommendations for acceptance criteria as documented in the TDI Owners Group connecting rod bearing shells Phase I Report. This is to be performed prior to installation of any replacement bearing shells.

The following Quality revalidation inspection recommendations are made to ensure proper component quality and performance and should be performed on both diesel engines:

- Perform a visual inspection of the connecting rod bearing shells.

- Perform a liquid penetrant test on the connecting rod bearing shells.
- Perform a dimensional check of the connecting rod bearing shells.
- Perform a radiographic inspection of the connecting rod bearing shells.
- Perform an eddy current test as required to identify surface discontinuities.

There are no modification recommendations for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Piston

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-341A

TASK DESCRIPTION NO. DR-12-02-341A-0

SNPS GPL NO. 03-341A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

A design review is not required for this component based on the November, 1984 Phase I report titled, "Investigation of Types AN and AH Piston Skirts". This Phase I report is applicable to WNP-1 since both engines (75084 and 75085) have AH skirts.

The Phase I report includes a review of the service history of the AH piston skirt. Two separate approaches were undertaken in this review. One approach relied on information supplied by TDI and showed a positive operating experience for engines with AH skirts. The other approach used the EDG Component Tracking System and showed no reported negative experience due to AH piston skirt initiated events. There is no reported site experience in the Component Tracking System.

The Phase I report concludes that based on the combination of experiments, analysis, and field observations, there is no reason to expect that the AH piston skirt is not suitable for service.

There are no maintenance or modification recommendations for this component.

The following Quality inspection as delineated in the CQRC is recommended:

- Perform a liquid penetrant test on the piston skirts. Map all linear indications in the stud boss area and document with photographs.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON K.T. Fitzpatrick PROGRAM MANAGER J C Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Piston: Rings
UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-341B
TASK DESCRIPTION NO. DR-12-02-341B-0

SNPS GPL NO. 03-341B
CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the Comanche Peak and Shoreham DR/QR reports, which establish the acceptability of the piston rings for their intended purpose.
- The applicable engine dimensions and operating parameters at WNP-1 are identical or very similar to those for the same component at Comanche Peak (lead engine).
- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.

Maintenance recommendations based on the Comanche Peak DR/QR report to ensure proper performance under normal operating conditions are as follows:

- Inspect and measure replacement piston rings in accordance with TDI inspection and maintenance records.
- To assure freedom from harmful scuffing, the cylinder liners should be inspected at each fuel outage to evaluate liner wear and coke deposits. Ring replacements and cylinder liner honing should be performed in accordance with TDI maintenance procedures. Borescopic inspection is acceptable if heads are not removed.
- When replacing engine oil use H.D. oil that exceeds series 3 standards. The base stock should be more resistant to thermal degradation and coke formation. The additive package should provide high detergent dispersant properties with high alkalinity and a high level of antiwear additive such as zinc dithiophosphate. Total Base Number (TBN) should be 12 to 15 for use with No. 2 fuel oil and a sulfated ash content of 1.5% to 2.0% is preferred. An engine oil with such properties, Mobilguard 412 or equivalent product, may be used to ensure improved lubrication.
- 135° fuel oil spray tips may be used if inspections results indicate a need for additional action to improve lubrication and reduce coke buildup.

The following Quality revalidation inspection is recommended to ensure component quality:

- Verify piston ring installation is in compliance with TDI assembly requirements for all station engines.

There are no modification recommendations for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Piston Pin Assembly UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-341C TASK DESCRIPTION NO. DR-12-02-341C-0

SNPS GPL NO. 03-341C CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for this component based on review of the lead engine DR/QR reports (Shoreham/Comanche Peak) and the reported applicable industry experience. There is no site experience in the EDG Component Tracking System.

The maintenance recommendations for this component are as follows:

- Visually inspect all pins for chrome plate damage.
- Inspect end plugs and reroll or replace any that are loose.

  Note: The above inspections should be performed during major engine overhauls and also whenever the pistons are removed and disassembled to an extent that such inspections are possible.

- Perform a liquid penetrant test or a magnetic particle test on all new or replacement pins before installation in engines.

There are no modification recommendations for this component.

The following Quality inspections as delineated in the CQRC are recommended:

- Perform a material comparator and hardness test on three on-engine wrist pins and one spare wrist pin.
- Visually inspect the rolled-end oil plug installations.
- Visually inspect the wrist pins for signs of distress.
- Perform a dimensional check of one spare wrist pin.

Note: Inspections to be performed on four wrist pins - except where noted.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Tappets and Guides: Intake & Exhaust Tappet Assembly

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-345A

TASK DESCRIPTION NO: DR-12-02-345A-0

SNPS GPL NO. 03-345A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the review of applicable industry experience and the lead engine DR/QR report (Comanche Peak). There is no reported site experience for this component in the EDG Component Tracking System.

The following routine maintenance is recommended for this component:

- Verify that the intake and exhaust tappet rollers are free to rotate, and that there is no measurable clearance between the cam rollers and roller pins. This inspection should take place at each outage using TDI inspection and maintenance record form 345-1-1.

There are no modification recommendations for this component.

The following Quality inspection is recommended to be performed on all engines:

- Verify that the intake and exhaust rollers are free to rotate and that no measurable clearance exists between the pin and roller.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _______ PROGRAM MANAGER _______

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Tappets and Guides: Fuel Tappet Assembly

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-345B

TASK DESCRIPTION NO. DR-12-02-345B-0

SNPS GPL NO. 03-345B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the review of applicable industry experience and the lead engine DR/QR report (Comanche Peak). There is no reported site experience for this component in the EDG Component Tracking System.

The following routine maintenance is recommended for this component:

- Verify that the fuel tappet rollers are free to rotate and that there is no measurable clearance between the cam roller and roller pin. This inspection should take place at each outage using TDI inspection and maintenance record form 345-1-1.

The are no modification recommendations for this component.

The following Quality inspection is recommended to be performed on all engines:

- Verify that the fuel tappet rollers are free to rotate and that no measurable clearance exists between the pin and roller.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John Cadogan PROGRAM MANAGER Lynn T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Tappets and Guides-Fuel Pump Base Assembly UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-345C TASK DESCRIPTION NO: DR-12-02-345C-0

SNPS GPL NO. 03-345C CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review of this component for WNP-1 is not required based on the review of applicable industry and site experience from the EDG Component Tracking System. No experience items have been reported. The fuel pump base assembly (assembly # IA-3443), is the same as that used at Comanche Peak, Grand Gulf and San Onofre. The two San Onofre engines have run 555 hrs and 723 hrs respectively with no reported problems with the fuel pump base.

There are no maintenance or modification recommendations for this component. However, initial bolt torque should be as specified in the TDI Manual.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cudlog PROGRAM MANAGER D C Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Camshaft: Camshaft Assembly	UTILITY Washington Public Power Supply System
GROUP PARTS LIST NO. 02-350A	TASK DESCRIPTION NO. DR-12-02-350A-0
SNPS GPL NO. 03-350A	CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the Comanche Peak and Shoreham DR/QR reports, which establish the acceptability of the cam shaft assembly for its intended purpose.
- The applicable engine dimensions and operating parameters at WNP-1 are identical or very similar to those for the same component at Comanche Peak (lead engine).
- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.

Maintenance recommendations based on the Comanche Peak DR/QR report to ensure proper performance under normal operating conditions are as follows:

- Perform a visual inspection of all cam lobe surfaces for signs of cracking, pitting or spalling, at each outage. Any signs of cracking, pitting or spalling shall be followed by a detailed analysis to evaluate the expected life based on the size and extent of surface distress and any corrective measures shall be implemented as indicated by this analysis. Signs of spalling shall result in immediate replacement of the cam.

There are no modification recommendations for this component.

The following Quality revalidation inspection recommendations are made to ensure proper component quality and performance and should be performed on both diesel engines:

- Visually inspect the cam lobes for indications of premature wear.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

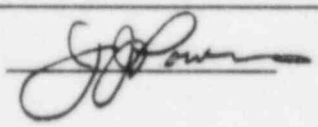
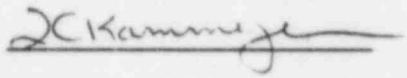
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Camshaft: Camshaft Bearing UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-350B TASK DESCRIPTION NO. DR-12-02-350B-0

SNPS GPL NO. 03-350B CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for this component based on the Comanche Peak lead engine DR/QR report, which establishes the acceptability of the camshaft bearings.

A review of the EDG Component Tracking System indicates no significant applicable site or industry experience.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

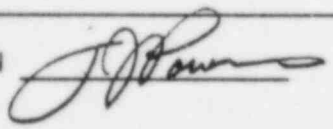
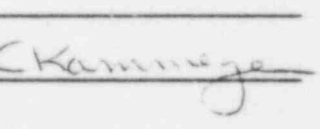
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

WN3370/1

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Camshaft - Supports, Bolting and Gear; Idler Gear Assembly - Crank to Pump Gear; Idler Gear Assembly - Idler Gear Assembly

UTILITY Washington Public Power Supply System

DR-12-02-350C-0
355A
355B

GROUP PARTS LIST NO. 02-350C,02-355A,02-355B

TASK DESCRIPTION NO:

SNPS GPL NO. 03-350C, 03-355A, 03-355B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for these components based on the lead engine DR/QR report (Comanche Peak), which establishes the acceptability of the gear train assembly. The gear tooth load calculations performed in the analysis of the Comanche Peak gear train demonstrate the acceptability of the WNP-1 gear train; the inputs to the calculations are equivalent and the parts are the same.

A review of the EDG Component Tracking System indicates no significant applicable industry or site experience.

The following maintenance recommendations are made to ensure reliability of the components:

02-350C, Camshaft - Supports, Bolting and Gears:

- It is recommended that the cam gear be inspected during scheduled refueling outages. The inspection should be directed at pitting. Any abnormal situations or indications of progressive pitting should reported for an engineering evaluation. A photographic record of tooth surfaces should be maintained at the site to aid in the evaluation of the surface durability.

- If the cam gear and hub are disassembled and reassembled for any reason, it is essential that the nut be re-locked at the position corresponding to the prescribed torque range. Insertion of the cotter pin must be accomplished at a torque greater than 50 ft-lbf and less than 90 ft-lbf. If this is not possible, another bolt and/or nut and/or washer should be used.

02-355A, Idler Gear Assembly - Crank to Pump Gear:

- It is recommended that the crank to pump gear and especially the jacket water pump drive and driven gear be inspected during scheduled refueling outages. The inspection should be directed at pitting. Any abnormal situations or indications of progressive pitting should be reported for an engineering evaluation. A photographic record of tooth surfaces should be maintained at the site to aid in the evaluation of the surface durability.

02-355B, Idler Gear Assembly - Idler Gear Assembly:

- It is recommended that the idler gear be inspected during scheduled refueling outages. The inspection should be directed at pitting. Any abnormal situations or indications of progressive pitting should be reported for an engineering evaluation. A photographic record of tooth surfaces should be maintained at the site to aid in the evaluation of the surface durability.

- The mating surfaces between the idler gear and hub should be thoroughly cleaned with solvent prior to assembly to ensure that there is an adequate friction coefficient between the parts.

- If the idler gear and hub are disassembled and reassembled for any reason, it is essential that the nut be relocked at precisely the position corresponding to the prescribed torque range. The idler gear-to-hub bolt torque specification should be 80 ± 20 ft-lbf. If the cotter pin cannot be inserted at a torque greater than 60 ft-lbf and less than 100 ft-lbf, another bolt, washer, and/or nut should be used.

There are no modification recommendations for these components.

It is recommended that the Quality inspections listed below be performed and submitted for engineering evaluation.

02-350C, Camshaft - Supports, Bolting and Gears:

- Verify that the proper torque values are applied to the bolts (cam to cam gear) on Engines A and B.

- Perform a visual inspection of the cam gear for signs of wear, pitting or any other discontinuities, on Engines A and B.

- Determine the hardness of the cam gears, Engine A.

- Determine the material of the cam gears, Engine A. Material to be AISI 4340.

02-355A, Idler Gear Assembly - Crank to Pump Gear:

- After 100 hours run or pre-operational testing, perform a visual inspection on the crank to pump gear set teeth for signs of wear, pitting, or any other discontinuities. Engines A and B.
- Determine the hardness of the crank to pump gear. Engine A.
- Determine the material of the crank to pump gear. Engine A.

02-355B, Idler Gear Assembly - Idler Gear Assembly:

- After 100 hours run or pre-operational testing, perform a visual inspection of the gear teeth for signs of pitting, wear, chips/nicks, etc. Provide photographs of the gear teeth. (TDI P/N 02-355-01-0E) Engines A and B.
- Determine the hardness of the gear teeth (TDI P/N 02-355-01-0E), Engine A. Hardness to be 380-405 Brinell.
- Determine the material of the gear teeth (TDI P/N 02-355-01-0E), Engine A. Material to be AISI 4340.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

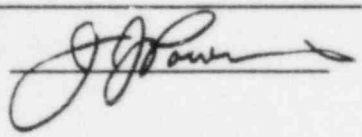
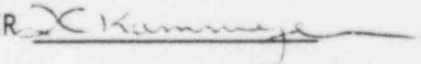
Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Rocker Shaft Assemblies: Intake/Intermediate & Exhaust

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-390A&B

TASK DESCRIPTION NO. DR-12-02-390A&B-0

SNPS GPL NO. 03-390A&B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the Comanche Peak and Shoreham DR/QR reports, which establish the acceptability of the rocker shaft assemblies for their intended purpose.

- A review of nuclear and non-nuclear industry experience listed in the EDG Component Tracking System indicated that there had been no design related failures associated with this component. There is no site experience listed in the Component Tracking System.

There are no maintenance or modification recommendations for this component.

The following Quality Revalidation inspection recommendations are made to ensure proper component quality and performance:

- Perform a visual inspection (both engines) of the intake, intermediate and exhaust rocker arm assemblies for signs of distress, linear indications and chipped pieces in the swivel pads and outer lips of the pushrod cups. The lips should be flush in the assembly.

- Perform a material comparator test on one intake/intermediate rocker arm shaft and one exhaust rocker arm shaft (one engine only).

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Rocker Arms and Pushrods:
Exhaust Rocker Shaft Assembly

COMPONENT PART NO.: 02-390B

See Component Part No.: 02-390A

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Main and Connector Pushrods UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-390C&D TASK DESCRIPTION NO. DR-12-02-390C&D-0

SNPS GPL NO. 03-390C&D CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the Comanche Peak and Shoreham DR/QR Reports, which establish the acceptability of the friction welded pushrods for their intended purpose.
- A review of the industry and site experience listed in the EDG Component Tracking System indicated there had been no design related failures associated with friction welded pushrods.

There are no maintenance or modification recommendations for this component.

The following Quality inspections are recommended to assure proper component quality and performance and should be performed on all pushrods (both engines):

- Verify that the main and connector pushrods are friction welded.
- Perform a liquid penetrant test on the friction welded main and connector pushrods. As an alternative, visual inspection may be used if a thorough wipedown of the surface is done to remove any coatings or deposits on the surfaces. No surface cracks should be allowed along the bond line between the rod end and the tube.

For future purchases of pushrods, it is recommended that the purchase order specify destructive verification of weld quality by sectioning random samples from each manufacturing lot.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Rocker Arms and Pushrods:
Pushrods Connector

COMPONENT PART NO.: 02-390D

See Component Part No.: 02-390C

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Rocker Arms & Pushrods: Bushings
UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-390E
TASK DESCRIPTION NO. DR-12-02-390E-0

SNPS GPL NO. 03-390E
CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the Comanche Peak and Shoreham DR/QR reports, which establish the acceptability of the bushings for their intended purpose.
- The applicable engine dimensions and operating parameters at WNP-1 are identical or very similar to those for the same component at Comanche Peak (lead engine).
- A review of the EDG Component Tracking System indicated that there was no site experience and no significant applicable nuclear or non-nuclear industry experience.

Maintenance recommendations based on the Comanche Peak DR/QR Report to ensure proper performance under normal conditions are a follows:

- Visually inspect and measure the intake, intermediate, and exhaust rocker arm bushings. The periods of engine operation to wear the bushings from an initial clearance of 0.0045 inch (diametral) to 0.010 inch (value at which bushings should be replaced) were calculated to be: 2300 hours - Intake, 730 hours - Intermediate, and 1300 hours - Exhaust. It is recommended that an inspection be conducted at the fuel outage which precedes the applicable number of engine hours of operation by at least the sum of the expected hours of operation in a LOOP/LOCA event plus the expected hours of operation between outages. The inspection schedule may be revised after the first or subsequent inspections if the inspection results justify a longer period of engine operation between inspections.

No modifications are recommended for this component.

No Quality revalidation is required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Rocker Arms and Pushrods: Lifters

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-390F

TASK DESCRIPTION NO. DR-12-02-390F-1

SNPS GPL NO. 03-390F

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the Comanche Peak and Shoreham DR/QR reports, which establish the acceptability of the hydraulic lifter for its intended purpose.

- A review of nuclear and non-nuclear industry experience listed in the EDG Component Tracking System indicated that there had been no design related failures associated with this component. There is no site experience listed in the Component Tracking System.

The only adverse experience with this component involves collapsed lifters which occurred when the lifters were installed upside down. The maintenance inspection recommendation below will eliminate this possibility.

- Verify that the hydraulic lifters are installed with the plunger (hole side up) at the top of the lifter assembly, and the barrel at the bottom.

There are no modification recommendations for this component.

The following Quality revalidation inspection recommendation is made to ensure proper component quality and performance and should be performed on both diesel engines:

- Perform a leak down rate test on the lifters.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

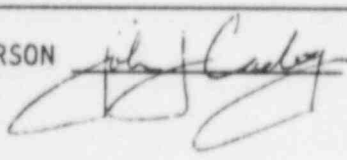
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER K.T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Rocker Arms and Pushrods - Misc. Bolts and Drive Studs

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-390G

TASK DESCRIPTION NO DR-12-02-390G-0

SNPS GPL NO. 03-390G

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on applicable industry experience, the Phase I report, and the lead engine DR/QR report (Comanche Peak). There is no site experience in the EDG Component Tracking System for this component. The industry experience of rocker arm bolt failures has been attributed to insufficient preloading.

The following maintenance recommendation is made for this component to improve reliability:

- Verify that the proper torque is applied to the rocker arm bolts (365 ft-lbs). This inspection should take place at each refueling outage if the rocker arms are disassembled for inspection.
- Verify that the rocker arm drive studs are intact and tight. This inspection should also be performed at each outage.

There are no modification recommendations for this component.

The following Quality inspections are recommended to be performed on all station engines:

- Verify that the proper torque loads are applied to the rocker arm capscrews.
- Perform a magnetic particle test on the thread root area of all capscrews for linear indications.
- Perform a material comparator test on four capscrews.
- Perform a hardness test on four capscrews.
- Perform a visual inspection on the drive studs for signs of irregularity.
- Verify that there is no movement of the drive studs in the rocker arm.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Carlogan PROGRAM MANAGER K.J. Fitzpatrick for JCK

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Front Gearcase Bolting UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-335B TASK DESCRIPTION NO. DR-12-02-335B-0

SNPS GPL NO. 03-335B CLASSIFICATION TYPE C

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated no significant applicable industry or site experience.
- The WNP-1 gearcase and bolting are the same as those used at Comanche Peak. The Comanche Peak bolting was found acceptable in the Comanche Peak design review.

There are no special maintenance requirements identified in the lead engine report, however a QC inspection of the bolts at Shearon Harris (CP&L NCR 84-177) showed two bolts internal to the gearcase that were not evident on the parts manual drawing. These two bolts are part of the perimeter bolt pattern that attaches the cover to the block but are internal and must be accessed by removing a cover plate or the governor support assembly. These bolts must be torqued the same as the other bolts. The CP&L inspection found that no positive means of locking was provided. Considering the damage these bolts could cause if they loosen, it is recommended that these bolts be inspected at WNP-1 positive locking features (bent tab or lockwire) be added, and that they be properly torqued in accordance with the TDI Manual.

There are no special modification requirements in the lead engine DR/QR report.

The following Quality inspection should be performed on each engine:

- Verify that the proper grade bolting and bolt torque values are used for the gearcase.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cudoza PROGRAM MANAGER J C Kammeyer

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Idler Gear Assembly:
Crank To Pump Gear

COMPONENT PART NO.: 02-355A

See Component Part No.: 02-350C

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Idler Gear Assembly:
Idler Gear Assembly

COMPONENT PART NO.: 02-355B

See Component Part No.: 02-350C

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Flywheel

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-330A

TASK DESCRIPTION NO. DR-12-02-330A-0

SNPS GPL NO. 03-330A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- There is no significant applicable nuclear or non-nuclear industry experience listed in the EDG Component Tracking System. There is no site experience listed in the Component Tracking System.
- The DR/QR report for Comanche Peak indicated a large factor of safety for the flywheel. The flywheels at WNP-1 and Comanche Peak are very similar and have the same TDI Part No. (02-330-02-AF).

There are no maintenance or modification recommendations for this component.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Flywheel Bolting

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-330B

TASK DESCRIPTION NO. DR-12-02-330B-0

SNPS GPL NO. 03-330B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review of this component for WNP-1 is not required based on following:

- A review of applicable industry experience from the EDG Component Tracking System indicated that no significant experience items have been reported. No experience items have been reported at WNP-1 from the Component Tracking System.
- The flywheel bolting at WNP-1 is very similar to that at Comanche Peak, which was previously reviewed and found acceptable. The flywheel, bolts and nuts are the same part number for both Comanche Peak and WNP-1. The crankshaft torque excursions are also very similar.

There are no maintenance or modification recommendations for this component.

The following Quality inspection should be performed:

- Use of the proper flywheel bolt torque should be verified as required in the CQRC.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Specification 9779-53, Rev. 6, 1/27/77 "Diesel Generators" for the WPPSS Nuclear Project Nos. 1 and 4.

SWEC Calculation Number 11600.60-NM(B)-001-CZC-004 "Flywheel Mounting bolts Design Review and Seismic Qualification."

Telecon, Peter Titus of SWEC, and Lisa Shusto of FAA, December 19, 1984 providing torque excursions for the WNP-1 and TVA Plants (formal confirming memorandum to follow).

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER JC Kammerzell

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Engine and Auxiliary Module Wiring Material and Fittings Pyrometer Conduit Assembly Conduit Fittings and Supports

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-688A & 02-630 A,B,C

TASK DESCRIPTION NO. DR-12-02-688A-0 DR-12-02-630 A,B,C-0

SNPS GPL NO. 03-688A & 03-630 A,B,C

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated no significant applicable industry and/or site experience.
- A review of the lead engine DR/QR Report (Comanche Peak)
- A review of as-built drawings for WNP-1

The detailed modifications listed in the lead engine DR/QR report (Comanche Peak) are not applicable to WNP-1, because of the differences in the conduit layout and conduit supports.

Based on past experience, and review of as-built drawings (DWG No. CS-1302A-001-1 to CS-1302A-013-1 and CS-1301B-001-1 to CS-1301B-013-1), and the results of analysis (Calc. No. 11600.60/CS-11) using input from specification SPEC 9779-53, it is recommended to perform an upgrade to tighten/fix, replace or add missing conduit supports as required. Additional supports are recommended for flexible conduits at one location for each engine (Ref. Memo from AYC Wong to J. C. Kammeyer, dated 1-4-84).

There are no routine maintenance recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Pyrometer Conduit Assembly:
Conduit Fittings

COMPONENT PART NO.: 02-630B

See Component Part No.: 02-630A

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Pyrometer Conduit Assembly:
Support

COMPONENT PART NO.: 02-630C

See Component Part No.: 02-630A

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Pyrometer Conduit Assembly Thermocouples

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-630D

TASK DESCRIPTION NO. DR-12-02-630D-0

SNPS GPL NO. 03-630D

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the lead engine DR/QR report (Comanche Peak), which establishes the acceptability of the thermocouple for its intended purpose.
- A review of the EDG Component Tracking System indicates no significant applicable site, nuclear or non-nuclear industry experience.
- The applicable engine dimensions and operating parameters at WPN-1 are identical or very similar to those for the same component at Comanche Peak.

There are no modification recommendations for this component.

Maintenance recommendations, based on the Comanche Peak DR/QR report, to ensure proper performance of the thermocouples during normal operation are as follows:

- Check that each thermocouple's indicated temperature is consistent with the engine's ambient temperature when the engine is cold. Any inconsistent reading traced to the thermocouple should result in replacement of the thermocouple. This is to be conducted during each refueling outage.
- Remove, clean and inspect each thermocouple and thermocouple shield for indications of fatigue. Any indications of fatigue should result in replacement of the thermocouple and/or thermocouple shield. This will be conducted during alternate refueling outages.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

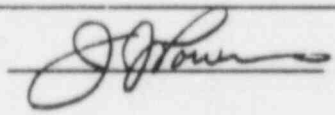
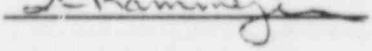
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Engine & Aux Module Wiring Material - Conduit & Fittings:
Pyrometer Assembly - Conduit, Fitting, Supports

COMPONENT PART NO.: 02-688A

See Component Part No.: 02-630A

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Engine & Auxiliary Module Wiring Materials: Wiring and Terminations

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-688B

TASK DESCRIPTION NO. DR-12-02-688D-0

SNPS GPL NO. 03-688B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the lead engine DR/QR report for Vogtle.
- A review of the EDG Component Tracking System indicated that there was no significant applicable industry and site experience that had not been addressed in the Vogtle DR/QR report.
- The wiring used for this component is similar to that used on the Vogtle engine.

The modification recommendation in the Vogtle DR/QR report regarding implementation of the TDI Service Information Memo (SIM) No. 361 also applies to this engine and should be implemented.

There are no maintenance recommendations from the Vogtle DR/QR report for this component.

The Vogtle DR/QR report details all material used in this component and evaluates acceptability of functional attributes.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. TDI Service Information Memo (SIM) No. 361, dated October 21, 1983; Subject: 1E Nuclear Qualified Cable.

2. TDI Vendor Instruction Manuals - Volumes I, II & III.

3. Telecon from J. Martin (SWEC) to C. Kinsell (United Engineers), dated November 20, 1984.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Carlogan PROGRAM MANAGER Jeanine T. Fitzpatrick

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Eng. & Aux-Module Wiring Mat'l- Boxes & Terminals UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-688C REV. NO. 1

SNPS GPL NO. 03-688C

TASK DESCRIPTIONS

No further review of component 02-688C is required for the following reasons:

a) Boxes and terminals were reviewed on the lead engine (Shoreham) and inspection results were satisfactory. In addition, terminals were reviewed as part of component 02-688B.

b) There is no site or industry experience reported for this component.

GROUP CHAIRPERSON Victor A Saleta PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Off-Engine Alarm Sensor Wiring

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-689

TASK DESCRIPTION NO. DR-12-02-689-0

SNPS GPL NO. 99-691B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR report for Comanche Peak.
- The wiring used for this component is similar to that used on the lead engine (Comanche Peak).

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Cerlogo PROGRAM MANAGER K.T. Fitzpatrick for JCK

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT On-Engine Alarm Sensors UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-690 TASK DESCRIPTION NO. DR-12-02-690-0

SNPS GPL NO. 03-690 CLASSIFICATION TYPE B

TASK DESCRIPTIONS

A design review for the on-engine alarm sensors is not required for WNP-1 based on the following:

- A review of the lead engine DR/QR report (Comanche Peak)
- The on-engine alarm sensors used on WNP-1 are identical to those at Comanche Peak, with the regard to manufacturer and application. There are a greater quantity of Barksdale differential pressure switches at WNP-1 to provide a DC fuel pump strainer high differential pressure alarm.
- There is no WNP-1 site, or non-nuclear industry experience listed in the EDG Component Tracking System. Nuclear industry experience listed showed no significant experience items.

There are no maintenance or modification recommendations for the on engine alarm sensors.

Quality revalidation of the on-engine alarm sensors is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Off-Engine Alarm Sensors UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-691 TASK DESCRIPTION NO. DR-12-02-691-0

SNPS GPL NO. 99-691A CLASSIFICATION TYPE B

TASK DESCRIPTIONS

A design review for the off-engine alarm sensors is not required for WNP-1 based on the following:

- A review of the DR/QR lead engine report (Comanche Peak).
- The off-engine alarm sensors used at WNP-1 are similar to those on Comanche Peak with regard to manufacturer and application.
- There is no WNP-1 site, nuclear or non-nuclear industry experience listed in the EDG Component Tracking System for the off-engine alarm sensors.
- Magnetrol level switches F-528-021 operate in the lube oil system to provide a low lube oil sump level alarm. These level switches will operate within ambient temperatures of -30°F to 180°F and are of adequate design to perform their intended function.
- WNP-1 also uses a greater quantity of pressure switches, F-577-044, F-577-058, F-577-060, F-577-069 to sense lube oil and starting air air pressures for alarm and air pressure control. These pressure switches will operate within ambient temperatures of -65°F to 165°F for F-577-058, -20 to 165°F for F-577-044 & F-577-069 and 0°F to 130°F for F-577-060. The switches are adequate for their intended function at WNP-1.

There are no maintenance or modification recommendations for the off-engine alarm sensors.

Quality revalidation of the off-engine alarm sensors is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Overspeed Trip-Governor UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-410A TASK DESCRIPTION NO. DR-12-02-410A-0

SNPS GPL NO. 03-410A CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for this component, based on the Shoreham and Comanche Peak lead engine DR/QR reports, which establish the acceptability of the overspeed trip governor.

A review of the EDG Component Tracking System indicates no significant applicable industry or site experience.

The following maintenance items, from the lead engine DR/QR report (Shoreham), are recommended for WNP-1 to ensure reliability of the overspeed trip governor:

- Modify the surveillance testing procedures to include verification that the overspeed trip is correctly set to an overspeed trip setting of 518 rpm +/- 1% at every refueling outage. Ensure that both the electric governor and the mechanical backup governor are properly returned to their normal settings following the overspeed test. The test is to be performed with no load on the engine by increasing the normal governor's speed setting(s) until a trip occurs. After several inspection periods, the history of the required adjustments should be reviewed to evaluate and possibly modify the testing interval.

- After setting the overspeed governor, the adjustment screw positions should be marked with Torque-Seal to reveal any unintended changes in the set positions.

There are no modification recommendations for this component.

The following Quality inspections are recommended for Engines A and B to ensure component quality and performance:

- Verify proper installation and calibration of the governor overspeed trip in accordance with the Installation and Oil Supply Topic of Woodward Documentation, TDI Manual.

- Verify that proper operational procedures are used on the overspeed trip governor, in accordance with Woodward Documentation, TDI Manual.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Overspeed Trip: Governor and Accessory Drive Assembly UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-410B TASK DESCRIPTION NO. DR-12-02-410B-0

SNPS GPL NO. 03-410B CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for this component, based on the Comanche Peak lead engine DR/QR report, which establishes the acceptability of the overspeed trip and accessory drive gear and shafting. The component parts under review are identical.

A review of the EDG Component Tracking System indicates no significant applicable industry or site experience.

There are no maintenance or modification recommendations for this component.

The following Quality Revalidation inspection recommendations, to be performed on one station engine only, are made to ensure component quality and performance:

- Confirm that the material of the accessory drive gear, P/N 02-410-01-0A, is AISI 4340. Use material comparator test.
- Perform visual inspection of accessory drive gear for wear.
- Measure accessory drive gear shaft-to-bearing clearance.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Overspeed Trip: Couplings (Flexible and Spider) UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-410C TASK DESCRIPTION NO. DR-12-02-410C-0

SNPS GPL NO. 03-410C CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the Comanche Peak lead engine DR/QR report, which establishes the acceptability of the overspeed trip couplings. The parts under review are the same as those of the lead engine.

A review of the EDG Component Tracking System indicates no significant applicable industry or site experience.

The following maintenance recommendations should be implemented to improve the reliability of the WNP-1 design:

- Either modify the maintenance specifications to replace the Lovejoy coupling spiders at every refueling outage, or, during the refueling outages, test the coupling elastomer for hardness and replace it, if it has exceeded the coupling manufacturer's specification.

- Discontinue use of Loctite 680 on heavy interference fits, but use Loctite 609 in a manner prescribed by TDI SIM 363 during assembly.

- Modify the maintenance specifications to check for coupling shaft looseness during refueling outages.

- At the next refueling outage, remove the present Lovejoy couplings and replace with new units. The shafts upon which each half are to be mounted should be measured and machining modifications made to the coupling halves to keep the interference fit below 0.0005 inch. Other procedures outlined in SIM 363 should be followed, except with using Loctite 609 in place of 680 when reassembled.

There are no modification recommendations for this component.

The following Quality inspection is recommended to be performed:

- Perform a visual examination of the coupling for signs of wear, deterioration or any other discontinuities on Engines 1A and 1B.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON J J Powers PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Overspeed Trip Vent Valve

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-410D

TASK DESCRIPTION NO. DR-12-02-410D-0

SNPS GPL NO. 03-410D

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience. There was no site experience listed in the Component Tracking System.
- A review of the lead engine DR/QR reports (Shoreham and Comanche Peak).
- Similarity between WNP-1 and lead engine components (AMOT Model 4095B).

The following maintenance recommendation from the lead engine DR/QR report should be implemented:

- Replace valve O-rings every 5 years

There are no modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON Kevin T. Fitzpatrick PROGRAM MANAGER J. Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Governor Drive: Governor and Tachometer Drive Gear and Shaft

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-411A

TASK DESCRIPTION NO. DR-12-02-411A-0

SNPS GPL NO. 03-402A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for this component, based on the Comanche Peak lead engine DR/QR report, which establishes the acceptability of the governor drive gears and shafts.

A review of the EDG Component Tracking System indicates no significant applicable industry or site experience.

There are no modification or maintenance recommendations for this component.

The following Quality inspections are recommended to be performed on one station engine:

- Determine the material of the governor drive gear (P/N 02-411-01-0B) and governor driven gear (P/N 02-411-02-AB) by use of comparator. Material to be AISI 4142.

- Perform LP inspections of governor drive for fatigue cracks after pre-operational test or 100 hours running in the following areas:

  (a) Gear/shaft contact surfaces and surfaces immediately adjacent;

  (b) Gear pins and bores;

  (c) Vertical shaft/gear keyway:

  (d) Reduced shaft diameter at coupling.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

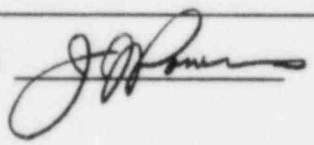
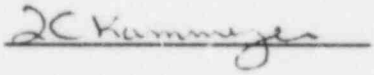
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Governor Drive: Couplings, Pins & Keys

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-411B

TASK DESCRIPTION NO. DR-12-02-411B-0

SNPS GPL NO. 03-402B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for this component, based on the Comanche Peak lead engine DR/QR report, which establishes the acceptability of the governor drive coupling, pins and keys.

A review of the EDG Component Tracking System indicates no significant site or applicable industry experience.

The following maintenance items are recommended to ensure reliability of this component:

- Replace the present neoprene inserts in the Koppers couplings before placing the engines in emergency standby service.
- Modify the maintenance schedule to include checking the coupling tightness at refueling outages. If the coupling is found loose, it should be removed, all mating surfaces cleaned, and the unit reassembled using Loctite 609 on the mating surfaces.
- Replace the elastomeric insert at refueling outages.

There are no modification recommendations for this component.

The following Quality inspections are recommended to be performed on Engines A and B:

- Verify that the elastomeric insert of the Koppers coupling is made of neoprene, by reviewing existing documentation.
- Verify that the set screw and drive pins are locked in place in accordance with installation instructions.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

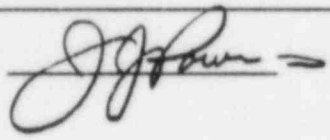
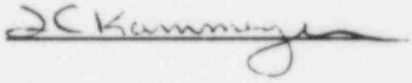
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Governor Linkage and Cross Shaft Assembly

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-413A

TASK DESCRIPTION NO. DR-12-02-413A-0

SNPS GPL NO. 03-413

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

A detailed design review of the governor linkage is not necessary for WNP-1 for the following reasons:

- A review of the governor linkage for both lead engines has indicated no inherent design flaws that cannot be addressed by appropriate maintenance procedures. Cross shaft and extensible parts are the same as used for Comanche Peak. The Comanche Peak governor linkage components were found acceptable.

- A review of the EDG Component Tracking System indicates only minor difficulties with integrity of mechanical fasteners. Other concerns relate to corrosion of the extensible linkage components. Corrosion of the extensible link has not been a problem for engines in nuclear standby service.

Verification of the integrity of the mechanical fasteners should be addressed by implementation of the following maintenance procedures:

- Monthly inspections for loose parts should be performed, and future tightening of this hardware due to loose parts should include the addition of lockwire to the lever arm clamp bolts and shaft roll pins.

- The cross shaft oilite bearing cups should be oiled monthly.

- The rod end fittings, especially those at the ends of the cross shaft should be greased at least at every outage.

The following Quality inspections are recommended to be performed on all station engines:

- Visually inspect the governor linkage for signs of corrosion, wear, pitting, and discoloration.

- Verify the installation of roll pins to hold the fuel control levers to the cross shaft.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Carlogan PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Governor Assembly: Woodward Governor	UTILITY Washington Public Power Supply System
GROUP PARTS LIST NO. 02-415A	TASK DESCRIPTION NO. DR-12-02-415A-0
SNPS GPL NO. 03-415A	CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for this component, based on review of the lead engine DR/QR report for Comanche Peak, which establishes the acceptability of the Woodward governor.

A review of the EDG Component Tracking System indicates no significant applicable industry or site experience.

The TDI suggested maintenance schedules, outlined in their instruction manual, should be carefully followed, including daily checks of the oil level, governor settings and mechanical connections, and annual replacement of the hydraulic oil.

The following maintenance recommendations should be implemented to improve component reliability:

- Modify the surveillance testing procedures to include an evaluation of the governor settings, by means of the two tests given below:

  (a) Perform a test of the governor settings, under joint electrical and mechanical governor control, off the grid in the isochronous mode.

  (b) Perform a test of the governor settings, under only mechanical governor control, off the grid in the isochronous mode.

These tests are to include examination of the engine speed transients under both start and transient loading conditions. They are to regularly ensure that the governor settings are appropriate to avoid the critical speed resonance at 496 rpm, specifically, that the overshoot of the 450 rpm set speed is no more than 7.5 percent or a maximum speed of 484 rpm, either during a start or when unloaded by the largest single load.

- Augment the setting adjustment procedures, as described in the Woodward manuals, to include tests of the governor response during an engine start to ensure agreement with the specifications indicated above.

- Modify the maintenance schedules to ensure that the hydraulic actuator is vented per the Woodward Instructions when more than a half quart of oil is added to the unit.

- Modify the cleanliness control specification to ensure that appropriate procedures are followed when adding or changing the governor oil so as not to contaminate fresh oil and the interior of the governor.

There are no modification recommendations for this component.

Quality Revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Governor Assembly Booster Servomotor

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-415B

TASK DESCRIPTION NO. DR-12-02-415B-0

SNPS GPL NO. 03-415B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the applicable industry experience in the EDG Component Tracking System and the lead engine DR/QR reports (Shoreham/ Comanche Peak). There is no reported site experience in the EDG Component Tracking System.

There are no maintenance or modification recommendations for this component.

The following Quality inspections are recommended to be performed on all engines:

- Booster servomotor should be mounted on the engine at a lower level than the governor to prevent air infiltration into the booster oil lines;
- The inlet and outlet lines for the booster should be 3/8-inch and 1/4-inch (or larger) tubing, respectively;
- Oil lines should slope upward from the booster to the governor and should have a minimum number of loops or bends.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Cadog — PROGRAM MANAGER Kevin T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Governor Assembly - Heat Exchanger

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-415C

TASK DESCRIPTION NO. DR-12-02-415C-0

SNPS GPL NO. 03-415C

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry and/or site experience, with the exception of cooler location. The governor oil cooler at WNP-1 was installed above the oil level in the governor and should be relocated.
- A review of the lead engine DR/QR report (Comanche Peak).
- The governor oil heat exchangers at WNP-1 and Comanche Peak were both furnished with Woodward EGB-35 governors.

There are no special maintenance or modification recommendations for this component.

The following Quality inspection is recommended to be performed.

- Verify that the cooler is mounted below the oil level in the governor, on each station engine.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Coulogan PROGRAM MANAGER J C Kammeyer

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

ENGINE SHUTDOWN EQUIPMENT - TUBING/FITTINGS & SUPPORTS
(SMALL BORE SCOPE ONLY)
COMPONENT PART NO. 02-695A

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the structural adequacy of the engine shutdown equipment - tubing/fittings and supports to withstand the effects of normal operating and earthquake loadings. The primary function of this component is to maintain the capability to effect engine shutdown.

II OBJECTIVE

The objective of this review was to perform an engineering evaluation of the tubing and supports to assure that the component will perform its intended design function during normal operating and earthquake loadings.

III METHODOLOGY

In order to meet the stated objective, the following methods were used:

- The TDI Emergency Diesel Generator Component Tracking System was reviewed for the WNP-1 site, nuclear, and non-nuclear industry experience. See Appendix C for results.
- The Quality Revalidation Checklist results were reviewed for acceptability.
- Both engines were partially assembled at the time of site inspection. This component was evaluated using actual walkdown information and by comparison to the Comanche Peak lead engine and Shoreham reports.

Refer to the review procedures as described in Reference 1 for a detailed methodology of this evaluation.

IV RESULTS AND CONCLUSIONS

The tubing and supports, as defined by this component Design Review, have been evaluated in accordance with Reference 1 and have been found acceptable with modifications.

The engine internal tubing and supports (line E19, high temperature bearing trip), as defined by this Component Design Review, have been found to be acceptable based upon the results obtained from the review of the comparable components on the DSR-48 engines at Shoreham, and in the fact that a review of all nuclear and non-nuclear industry experiences indicates that there are no design problems that affect the structural integrity of this component. In addition, it should be noted that because of spatial restrictions, all sections of unsupported tubing will meet acceptable span lengths.

There are no Quality Revalidation Checklist results or TERs associated with this component.

Based on the above review and information contained in Reference 2, it is concluded that the tubing/fittings and supports will perform their intended design function at WNP-1 under all normal operating and earthquake loadings with the provision that the following recommended modifications be implemented as detailed in Reference 3:

Engines A and B

All multi-tube spacers should have metal cover plates and should be rigidly attached to the engine. Two screws per spacer is considered minimum to provide adequate restraint. Partially empty spacer blocks should be filled using short tubing sections in the empty slots.

Two-directional restraints should be added to the following ¼-inch diameter tubes as shown on the engine pneumatic schematic such that the maximum tubing spans do not exceed 4 feet-0 inches. Location of restraints should accommodate thermal expansion by providing a 6-inch minimum offset around bends.

- Line E68 and the group of tubes running parallel to E68 - A multi-tube restraint should be added in the risers between the bulkhead at cylinder 1R and the first support.
- Line E32 - Between the bulkhead and the first support on the governor end of the engine.
- Line E46 - Between the fuel oil crossover header branch and the first bulkhead.
- Line E35 - Between the lube oil header branch and the first support.
- Line E33 - Left bank turbocharger, between the first and second supports from the cross fitting connection.
- Line E92 - Low pressure turbo oil between tie-in with Line E33 (TEE) and pressure sensor.

- Lines E24, E23H - Between the first and second supports from the turbo mounted vibro switch.

Engine A

- Line E34 - Right bank turbocharger, between the first and second supports from the cross connection.

- Lines E19, E53 - Right bank, generator end, between the third and fourth bulkheads similar to Engine B.

V REFERENCES

1. "Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 0.

2. Stone & Webster Calculation number 11600.60-NP(B)-1201XH

3. Memo No. 6596 from C. Malovrh/SWEC to J. Kammeyer/SWEC 12/21/84.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Engine Shutdown Equipment Tubing/Fittings (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO 02-695A

TASK DESCRIPTION NO.: DR-12-02-695A-0

SNPS GPL NO. 03-695A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Perform an engineering review of the tubing and supports to provide additional assurances that the component will perform its intended design function during normal operating and earthquake loading.

PRIMARY FUNCTION

Maintain capability to effect engine shutdown.

ATTRIBUTE TO BE VERIFIED

Structural adequacy of the tubing and supports due to the effects of normal operating and earthquake loadings.

SPECIFIED STANDARDS

IEEE 387; ANSI B31.1,"Power Piping"

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Delaval design documentation (specifications, calculations, drawings, etc.). In lieu of information from Delaval, the following information is required: verified support sketches and piping isometrics, material specifications, pipe size and schedule, and operating parameters (pressure, temperature, load combinations).

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Engine Shutdown Equipment: Tubing and Fittings

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-695A

REV. NO. 2

SNPS GPL NO. 03-695A

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

2. Obtain sufficient data to support the design review effort. This may be accomplished by developing quality verified as-builts in accordance with procedure DG-7, or by the Design Group performing a field walkdown.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

2. Information necessary for the design review effort

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package
2. Review of detailed information by the Design Group

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52
2. Procedure DG-7

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet
2. Quality verified as-built isometric drawings for the tubing and fittings if available from the Owner.

Engine B

Same as Engine A

GROUP CHAIRPERSON Steven M Schwartz PROGRAM MANAGER K.J. Fitzpatrick

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COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.

2. The Design Group will be responsible for closing out this item. This can be done per Procedure DG-7 or by the performance of an engineering walkdown by the Design Group.

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON Victor A. Sabata PROGRAM MANAGER K.I. Fitzpatrick

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-695A

Effective Printout Date: 11/30/84

COMPONENT TYPE: Engine Shutdown Equipment - Tubing/Fittings

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
Diesel tripped because of high jacket water temperature caused by low lube oil level. Engine ran successfully after oil added.	North Anna 2 LER 339-83054	Shutdown system worked properly. Does not affect component design or integrity.
Instrument line to cooling jacket water line was leaking. Cause found to be a crack in ¼-inch nipple.	Palisades LER 255-77000	Pipe nipples used at WNP-1 are schedule 80, which will prevent this problem. Design report for this component concludes that lines are adequately supported if the recommended modifications are implemented.
Air leak found on pressure gauge sensing line. Fittings were tightened and diesel operated properly.	Zion 2 LER 304-75000	Normal maintenance and operating procedures which consist of checking for leaks and loose fittings at a regular interval should eliminate this event.
Engine tripped because of air leak on line to fuel shutoff pistons.	Zion 1 LER 295-80028	Normal maintenance and operating procedures that consist of checking for leaks and loose fittings at a regular interval should eliminate this event.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
Diesel tripped because of a leak in a line to the master shutdown cylinder. Pipe nipple was replaced.	Zion 2 LER 304-77000	This was probably caused by inadequately supported piping. The Design Report for this component concludes that the WNP-1 lines are adequately supported if the recommended modifications are implemented. Also, pipe nipples used at WNP-1 are schedule 80, which will prevent this problem.
Diesel tripped because of split pipe nipple in control air system. Pipe nipple was replaced.	Zion 2 LER 304-770691-1	Pipe nipples used at WNP-1 are schedule 80, which will prevent this problem. The Design Report for this component concludes that the lines are adequately supported if the recommended modifications are implemented.
Dirt particles clogged small bleed-off orifice in air relay air start system.	Monticello 1 NPRDS 770411	Cleaning of the valves, regulators and orifices on a routing basis is recommended (See Design Report for 02-695B).

NON-NUCLEAR

None

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Engine Shutdown Equipment-Valves, Regulators, Orifices UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-695B TASK DESCRIPTION NO. DR-12-02-695B-0

SNPS GPL NO. 03-695B CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for the engine shutdown equipment - valves, regulators and orifices is not required for WNP-1 based on the following:

- A review of the lead engine DR/QR report (Comanche Peak).
- The application of the engine shutdown equipment valves, regulators and orifices used on WNP-1 is identical to Comanche Peak with the exception of the overspeed trip logic and California Controls Orifices, TDI Part No. F-573-391.
- There is no WNP-1 site or non-nuclear industry experiences listed in the EDG Component Tracking System for this component. The nuclear industry experience listed does not show any significant problems applicable to WNP-1 design.
- Comanche Peak utilizes one overspeed trip valve to provide a one-for-one trip logic whereas WNP-1 utilizes two overspeed trip valves to provide a two-out-of-two trip logic. The actuation of the overspeed valves, venting action and resulting shutdown on WNP-1 is identical to Comanche Peak if both overspeed trip valves sense the overspeed condition. It should be noted that air flow to the shutdown cylinders is blocked, preventing a shutdown if only one overspeed valve actuates on WNP-1. The overspeed trip logic operate in 60 psi dry air and is of adequate design to perform its intended function at WNP-1.

  Orifices F-573-391 are installed in series with the lube oil pressure switches to limit air passage during a low-low lube oil pressure trip. The orifices are sized such that two of the three lube oil switches must sense low-low pressure to allow sufficient air to vent off the shutdown board to affect a shutdown. The orifices are to operate in 60 psi dry air and are of adequate design to perform their intended function at WNP-1.

To minimize fouling of the engine shutdown equipment valves, regulators and orifices, it is recommended that the equipment be inspected and cleaned and the elastomeric parts be replaced during each refueling outage. This recommended maintenance interval should be reassessed depending on the degree of system fouling.

There are no recommended modifications for the engine shutdown equipment valves, regulators and orifices.

Quality revalidation for the engine shutdown equipment valves, regulators and orifices is not deemed necessary.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

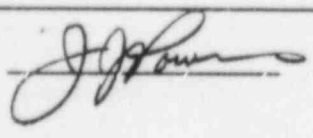
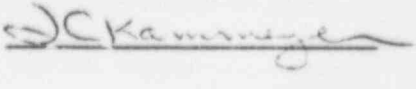
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Engine Shutdown Trip Switches

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-695C

TASK DESCRIPTION NO. DR-12-02-695C-0

SNPS GPL NO. 03-695C

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

A design review for the engine shutdown trip switches is not required for WNP-1 based on the following:

- A review of the lead engine DR/QR report (Comanche Peak).
- There is no WNP-1 experience listed in the EDG Component Tracking System for the trip switches. The applicable nuclear and non-nuclear industry experiences listed do not indicate any generic or significant problems with the trip switches.
- The engine shutdown trip switches used on WNP-1 are identical to Comanche Peak with regard to switch manufacturer and application. WNP-1 uses a greater quantity of low pressure switches in order to accommodate the two-out-of-three low lube oil pressure trip logic and a low jacket water pressure trip.

There are no maintenance or modification recommendations for the engine shutdown trip switches.

Quality revalidation of the engine shutdown trip switches is not deemed necessary.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

TDI DIESEL GENERATOR

DESIGN REVIEW AND QUALITY REVALIDATION REPORT

Prepared For

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

WPPSS NUCLEAR PROJECT 1

By

TDI DIESEL GENERATOR OWNERS GROUP

VOLUME 4

How To Use This Report

Tabs in this report identify the following categories:

Turbo, Intake, Intercooler & Exhaust
Lube Oil
Engine Base & Bearing Caps
Crankshaft & Bearings
Cylinder Block, Liners & Water Manifold
Air Start & Barring Device
Connecting rods
Pistons
Camshaft & Valve Train
Idler Gear Assembly & Front Gear Case
Flywheel
Engine Instrumentation & Wiring
Overspeed Trip & Governor
Engine Shutdown & Equipment
Jacket Water
Cylinder Heads & Valves
Fuel Oil Injection
Generator
Control Panel Assembly
Engine & Auxiliary Sub-Base & Foundation Bolts

These categories have been defined to allow the reader to review a complete diesel generator subsystem in a convenient manner.

Within each category tabs identify WPPSS Nuclear Project 1 specific component numbers.

A given component report can be found by:

a) If the component number is known - use the alpha - numberic index which identifies the volume number and category in which the component report is located.

b) If only the component name is known - Section 3.2 may be used as a cross-reference to find the volume number where the component report may be found.

Some reports address more than one component. a tab is provided for each component. However, some components are combined under one report. Slip sheets are provided where required to reference back to the appropriate tab. Some components required more than one report. These are identified by the abbreviation LB-Large Bore and SB-Small Bore on the component number tabs.

For the purpose of writing this report, the WPPSS Nuclear Project 1 engines were designated as A and B. The relation of these designations to other plant numbers associated with the engines is given in the table below.

Report Designation	Plant Mark Number	Engine Serial Number
A	EDG-DG-1-B	75084
B	EDG-DG-2-A	75085

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Manifold - Manifold Assembly with Hardware, Coupling and Gaskets (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-316A&B

TASK DESCRIPTION NO. DR-12-02-316A&B-0

SNPS GPL NO. 99-316A&B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak).
- A comparison of the jacket water manifold - manifold assembly with hardware for WNP-1 with Comanche Peak.

The following modification recommendations made on the lead engine DR/QR report should be implemented:

- The tie rod assembly surrounding the 6-inch Dresser coupling requires double-nutting to prevent inward axial movement. Also, 1-inch diameter rods are required to accommodate the compression load.
- The second support west of the 6-inch TDI custom flanges requires stiffening in the lateral direction to accommodate total support loads.

There are no maintenance or modification recommendations for these components.

The following Quality inspection is recommendaed to be performed:

- Verify the type of Dresser Coupling installed.

COMPONENT DESIGN REVIEW CHECKLIST

816A&B-0

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER J C Kammeyer

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Jacket Water Inlet Manifold:
Coupling and Gaskets

COMPONENT PART NO.: 02-316B

See Component Part No.: 02-316A

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Inlet Manifold-Manifold-Vent Line To Discharge Manifold

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-316C

TASK DESCRIPTION NO. DR-12-02-316C-0

SNPS GPL NO. 99-316C

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak). There is no site or industry experience for this component in the EDG Component Tracking System.

A field walkdown was performed at WNP-1. However, a review of this component was not possible due to its uninstalled condition at the time of the walkdown. Therefore, component acceptability and any subsequent recommendations shall be based upon the lead engine DR/QR report. This component is considered essentially the same as the lead engine component based on a comparison of assembly drawings from each of the TDI parts manual (Vol. II). Reference Dwg. No. 02-316-04.

There are no maintenance recommendations for this component. However, the lead engine report does address a support modification. Specifically, the report recommended the provision of a more suitable type of moment connection at the support to structural steel interface.

Therefore, based on the above review, it is concluded that this component will perform its intended design function at WNP-1 under all normal operating and earthquake loadings with the provision that the supports are verified or modified to have sufficient moment connection at the support to structural steel interface.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Corbogan PROGRAM MANAGER K.T. Fitzpatrick for Jck

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Discharge Manifold Piping (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-317A&B

TASK DESCRIPTION NO. DR-12-02-317A&B-0

SNPS GPL NO. 03-317A&B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak)
- A comparison of the jacket water discharge manifold supports for WNP-1 with Comanche Peak.

The following maintenance/modification recommendation made on the lead engine DR/QR report should be implemented:

- The Style 65 Dresser couplings are to be replaced with a new Dresser Style 90 or Style 165 coupling equipped with Viton gaskets, should leaks develop.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Cordaro PROGRAM MANAGER D C Kammeyer

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Water Discharge Manifold:
Coupling & Seals

COMPONENT PART NO.: 02-317B

See Component Part No.: 02-317A

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Water Discharge Manifold/Supports (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-317C

TASK DESCRIPTION NO. DR-12-02-317C-0

SNPS GPL NO. 03-317C

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak)
- A comparison of the water discharge manifold supports for WNP-1 with Comanche Peak.

The following modification recommendations made on the lead engine DR/QR report should be implemented:

- Ensure that the supports (attached to the water jacket shroud) on the two 5-inch headers have a minimum weld of 3-inches long on both sides to the longer end of the plate. Also, ensure that the welds between the existing 3/4-inch plate and engine block have a minimum weld of 1/4-inch along the total width of the plate.

There are no maintenance recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Casteloge — PROGRAM MANAGER Kevin T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Engine Driven Jacket Water Pump

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-425A

TASK DESCRIPTION NO. DR-12-02-425A-0

SNPS GPL NO. 03-425A

CLASSIFICATION TYPE A

TASK DESCRIPTION

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no site experience. Significant applicable industry experience was previously addressed in the lead engine report.
- A review of the lead engine DR/QR report (Comanche Peak).

The engine driven jacket water pumps at WNP-1 and Comanche Peak are of the same design, but the impellers on the WNP-1 pump are cut to smaller diameters for lower design flows so that the torques, and consequently the stress levels, are lower.

The following maintenance recommendations from the lead engine DR/QR report should be implemented.

- It is recommended that the key to keyway interface be checked for a tight fit on both the pump shaft and the impeller during pump reassembly. This, along with the drive fit of the impeller onto the shaft, will preclude past problems where relative motion between shaft and impeller caused fretting and upset of the keyway sides.
- It is also recommended that the key to keyway interface be checked for a tight fit on both the spline and the pump shaft during pump reassembly. This, along with the drive fit of the impeller onto the shaft, will preclude past problems where relative motion between spline and pump shaft caused fretting and upset of the keyway sides.
- The castle nut that drives the external spline on its taper does not have a maximum specified torque "not to be exceeded." As such, it is recommended that the minimum and maximum torque values of 120 ft-lb and 660 ft-lb, respectively, be included in the WPPSS maintenance procedures.

There are no modifications required for the pump based on the lead engine DR/QR report.

TASK DESCRIPTION (continued)

The following Quality inspections have not been performed to date and are recommended:

- Verify material of shaft with hardness and material comparator test.
- Disassemble jacket water pump and visually inspect gears to shaft for signs of excessive scoring wear on shaft and pitting or galling on gear teeth.

  Document any questionable items via photograph and submit to design group.
- LP roots of gear teeth and transition area (gear to shaft).
- Visually inspect clearance ring for evidence of galling or excessive wear. Document, via photograph, any questionable items and submit to design group.

NOTE: To be performed on one station engine only, provided no unsatisfactory generic conditions are noted.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

COMPONENT DESIGN REVIEW CHECKLIST

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER J C Kammeyer

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

JACKET WATER FITTINGS - PIPE AND FITTINGS
(LARGE BORE SCOPE ONLY)
COMPONENT PART NO. 02-435A

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the structural adequacy of the jacket water pipe and fittings for the effects of normal operating and earthquake loadings.

The primary function of the jacket water pipe and fittings is to carry jacket water from the engine pump discharge to the auxiliary skid jacket water piping.

The scope of piping embraced by this report includes the large bore (greater than 2-inch diameter) piping components as noted on the as-built information obtained during Impell field verification (Ref. 1), plus small bore piping, which was included because of the configuration.

Piping components are defined as piping spool pieces, elbows, tees, flanges, and the interconnecting welds. This scope is uniquely defined in terms of Transamerica Delaval, Inc. (TDI) part numbers in Reference 2.

II OBJECTIVE

The objective of this review was to verify the adequacy of the subject piping components for normal operating and earthquake loadings.

III METHODOLOGY

The evaluation of the piping components is performed in accordance with the philosophy and intent of the ANSI B31.1 Power Piping Code. Towards this end, a criteria document was developed, "Design Criteria for Diesel Generator Large Diameter Piping for WNP-1," which describes the background and provides the techniques for evaluating the subject piping. These criteria are presented in their entirety in Reference 2.

Quality Revalidation Checklist results were reviewed for acceptability.

The TDI Emergency Diesel Generator Component Tracking System was reviewed for the WNP-1 site, nuclear, and non-nuclear industry experience.

IV RESULTS AND CONCLUSIONS

All piping stresses were within the design allowables specified by the ANSI B31.1 Power Piping Code.

All pipe loads on the engine were tabulated and issued for evaluation. These evaluations were performed as part of the development of reports for component Nos. 02-425A and 02-810A.

The following maintenance recommendation is made:

- Ensure that the flange bolts at the on-engine jacket water pump are A-325 or better (based on ASME allowable stress) (Reference 3). 1

There are no Quality Revalidation Checklist results or TERs associated with this component.

Based on the above review, it is concluded that the subject piping components, with the above recommended modifications, are adequate for their intended design function at WNP-1.

V REFERENCES

1. "Supporting Calculations for the Evaluation of WNP-1 Diesel Generator Large Diameter Piping and Support," Impell Report No. 02-0630-1306, Rev. 0, December 1984.

2. "Design Criteria for Diesel Generator Large Diameter Piping for WNP-1," Impell Report No. 02-0630-1305, Rev. 0, December 1984. This is included in Appendix III of the final DR/QR report.

3. Letter from J. Ahrens (Impell) to J. C. Kammeyer (SWEC), "Required Modification for Validation of Impell's Design Review of Component 02-435A - WNP," Letter No. 0630-037-NY-143, dated February 4, 1985. 1

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Fittings - Pipe and Fittings (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-435A

TASK DESCRIPTION NO. DR-12-02-435A-0

SNPS GPL NO. 03-717D

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Evaluate structural integrity of the jacket water fittings piping spool pieces and fittings, for the effects of normal operating and earthquake loadings by (a) comparison to previous analyses, (b) review of previous quaiification documentation, and/or (c) actual performance of stress evaluation in accordance with the intent and philosophy of ANSI B31.1 Power Piping and Impell Design Criteria.

Review information provided on TERs.

PRIMARY FUNCTION

Carry jacket water from the engine pump discharge to the auxiliary skid jacket water piping.

ATTRIBUTE TO BE VERIFIED

Structural integrity of large bore (greater than 2 in. dia.) piping spool pieces and fittings to withstand the effects of normal operating and earthquake loadings.

SPECIFIED STANDARDS

None

REFERENCES

"Design Criteria for Diesel Generator Large Diameter Piping for WPPSS," Impell Report No. 02-0630-1305, Rev. 0, December 1984.

DOCUMENTATION REQUIRED

Verified piping isometric, material specification, size and schedule, design parameters (temp., pressure), contents and insulation.

GROUP CHAIRPERSON John F. Cadogan PROGRAM MANAGER Lynn T. Fitzpatrick

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Jacket Water Fittings Piping & Fittings

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-435A

REV. NO. 1

SNPS GPL NO. 03-435A

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

2. Obtain sufficient data to support the Design Review effort. This may be accomplished by developing quality verified as-builts in accordance with DG-7, or by the Design Group performing a field walkdown.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

2. Information necessary for the design review effort

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package
2. Review of detailed information by the Design Group

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52
2. Procedure DG-7

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet
2. Quality verified as-built isometric drawings for the piping and fittings if available from the owner.

Engine B

Same as Engine A

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.

2. The Design Group will be responsible for closing out this item. This can be done per procedure DG-7 or by performance of an engineering walkdown by the Design Group.

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-435A

Effective Printout Dates:
Industry - 12/12/84
WNP-1 Site - 12/13/84

COMPONENT TYPE: Jacket Water Fittings - Pipe and Fittings

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
Flow testing of heat exchanger found inadequate. Inspection revealed restriction in cooling water piping upstream/downstream of heat exchanger. Cooling lines flushed.	LER Brown's Ferry 3, 296-80016-1, 800513	Flushing of clogged or restricted lines is a maintenance concern and does not affect, nor is affected by, the structural evaluation of piping.
During surveillance testing a jacket water leak was identified on 1C diesel. Crack found on 3/8-inch pipe nipple. Apparent cause of this occurrence was fatigue stress caused by vibration of 3/8-inch carbon steel pipe nipple.	LER Salem 1 272-77000, 771117 EPRI-NP-2433, 6/82	Refer to small bore piping report (02-435A).
Leaking gasket on jacket water cooling discharge header required repair.	Calvert Cliffs 2 318-80003-1, 800110	Maintenance concern. Not related to the subject structural evaluation.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
During the monthly performance test on containment spray pump 2C, a cooling water hose on the diesel engine broke.	LER Zion 2 304-78071, 781108	Concern is for a cooling water hose. WNP-1 diesel does not use hoses; not applicable.

NON-NUCLEAR

None

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Fittings Pipe and Fittings (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. G2-435A

TASK DESCRIPTION NO. DR-12-02-435A-0

SNPS GPL NO. 03-435A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry and site experience listed in the EDG Component Tracking System.

As a maintenance recommendation, in the event of a leak developing in the existing Dresser Style 65 coupling, these coupling should be replaced with Dresser Style 90 coupling with Viton gaskets. This recommendation is made on the basis that the maximum suggested operating temperature of 150° F for the Style 65 coupling may be exceeded. The maximum suggested operating temperature of the Style 90 is 212° F.

A field walkdown was performed in accordance with the small bore piping criteria document (Ref. 1). However, portions of the component were not installed at the time of the walkdown. Therefore, component acceptability and any subsequent recommendations for the installed portions shall be based upon the lead engine report. It is concluded that this component will perform its intended function for normal and earthquake loadings, provided the following recommendation is incorporated:

- The governor oil cooler tubing should be installed as recommended by TDI and should have maximum span lengths no greater than 5'-6" between supports.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTES TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Fittings - Supports
Exhaust Manifold

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-435B

TASK DESCRIPTION NO. DR-12-02-435B-0

SNPS GPL NO. 03-435B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry or site experience.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak)

Based on previous experience, supports appear to be adequate provided that the analysis of corresponding piping component no. 02-435A does not mandate modifications. If the piping analysis warrants modifications to the supports, these modifications will be addressed in the DR/QR report for component no. 02-435A.

There are no maintenance recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John Cadogan PROGRAM MANAGER Kevin T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Fittings-Supports (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-435B

TASK DESCRIPTION NO. DR-12-02-435B-0

SNPS GPL NO. 03-435B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak). There is no site or industry experience for this component in the EDG Component Tracking System.

There are no maintenance or modification recommendations for this component.

A field walkdown was performed in accordance with the small bore piping and tubing criteria document (Ref. 1) and concluded that this component will perform its intended function for normal and earthquake loading.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTES TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cardoza PROGRAM MANAGER K.T. Fitzpatrick for JCK

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Inlet Fittings - Valves

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-435C

TASK DESCRIPTION NO. DR-12-02-435C-0

SNPS GPL NO. 99-435A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no industry or site experience.
- A review of the lead engine DR/QR report (Comanche Peak).
- Similarity of components - both plants have Durabla check valves, Model LC-2 and Whitey shutoff valves, Model IVM4-S4-CS.

There are no maintenance or modifications recommendations for this component, based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER JC Kammingen

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Standpipe: Pipe, Fittings and Gaskets (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-700A

TASK DESCRIPTION NO. DR-12-02-700A-0

SNPS GPL NO. 00-700A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry experience from the EDG Component Tracking System. There is no site experience for this component in the Component Tracking System.

There are no maintenance recommendations for this component. However, the lead engine report does address site specific additions of supports. The necessity for similar additions on WNP-1 is assessed below.

A field walkdown was performed in accordance with the small bore piping and tubing criteria document (Ref. 1) at WNP-1. However, a review of this component in its entirety was not possible since portions of the tubing on the air bubble removal system were not installed at the time of the walkdown. Component acceptability and recommendations shall be based on the walkdown and a review of the lead engine report (Comanche Peak).

It is concluded that this component will perform its intended function for normal and earthquake loading provided the jacket water vent lines of the air bubble removal system are installed in accordance with TDI drawing No. 09-810-75084 and that the supports are added/modified as indicated in DR/QR report 02-700B.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. "Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Conway PROGRAM MANAGER Kevin T. Fitzpatrick

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

JACKET WATER STANDPIPE - SUPPORTS
(SMALL BORE SCOPE ONLY)
COMPONENT PART NO. 02-700B

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the structural adequacy of the jacket water standpipe supports to withstand the effects of normal operating and earthquake loadings. The primary function of these supports is to provide adequate restraint of the small bore piping/tubing system in the intended support load directions for the loading conditions specified.

II OBJECTIVE

The objective of this review was to perform an engineering evaluation of the small bore pipe/tube supports to assure that the component will perform its intended design function during normal operating and earthquake loadings.

III METHODOLOGY

In order to meet the stated objective, the following methods were used:

- The TDI Emergency Diesel Generator Component Tracking System was reviewed for the WNP-1 site, nuclear and non-nuclear industry experience. See Appendix C for results.
- The Quality Revalidation Checklist results were reviewed for acceptability.
- Both Engines were partially assembled at the time of site inspection. This component was evaluated using actual walkdown information and by comparison to the Comanche Peak lead engine report.

Refer to the review procedures as described in Reference 1 for a more detailed methodology of this evaluation.

IV RESULTS AND CONCLUSIONS

The small bore piping/tubing supports, as defined by this Component Design Review, have been evaluated in accordance with Reference 1 and have been found acceptable with modifications.

There are no Quality Revalidation Checklist results or TERs associated with this component.

Based on the above review and information contained in Reference 2, it is concluded that the small bore piping/tubing supports will perform their intended design function at WNP-1 under all normal operating and earthquake loadings with the provision that the following recommended modifications be implemented as detailed in Reference 3:

STANDPIPE OVERFLOW LINE

Engines A and B

- All U-bolts should be replaced with 3/8 inch diameter U-bolts having proper locking devices and installed to provide a proper sliding fit.

- The lower three-directional restraint should be modified by reinstalling the axial stop lug to bear on the support bracket rather than on the U-bolt as currently installed.

In order to support the small bore piping/tubing of component 02-700A, it is recommended that the following supports be added:

A two-directional restraint should be installed near the base of the riser on Engine B similar to Engine A to limit axial motion of the horizontal run.

AIR BUBBLE REMOVAL SYSTEM

Portions of the tubing supports for the air bubble removal system were not installed at the time of the walkdown. Installation should be such that two-directional restraints are at a maximum spacing of 4-feet 6-inches for 1/4-inch diameter tubing and 5 feet 0 inch for 3/8-inch diameter tubing. A minimum offset of 6 inches around bends is required to accomodate thermal expansion.

V REFERENCES

1. "Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners Group," Report No. 11600.60-DC-02, Revision 0.

2. Stone & Webster Calculation Number 11600.60-NP(B)-1201-XH

3. Memo No. 6596 from C. Malovrh/SWEC to J. Kammeyer/SWEC dated 12/21/84.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Standpipe: Supports (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-700B

TASK DESCRIPTION NO. DR-12-02-700B-0

SNPS GPL NO. 00-700C

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Perform an engineering review of the small bore piping/tubing supports to assure that the component will perform its intended design function during normal operating and earthquake loadings.

PRIMARY FUNCTION

Provide adequate restraint of the small bore piping/tubing system in the intended support load direction.

ATTRIBUTE TO BE VERIFIED

Structural adequacy of the small bore pipe/tube supports due to the effects of normal operating and earthquake loadings.

SPECIFIED STANDARDS

ANSI B31.1 Power Piping 1973 Edition, Summer '74 Addendum

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners Group" Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Delaval design documentation (specifications, calculations, drawings, etc.). In lieu of information from Delaval, the following information is required: verified support sketches and piping isometrics, material specifications, pipe size and schedule, and operating parameters (pressure, temperature, load combinations).

GROUP CHAIRPERSON John J. Coologan PROGRAM MANAGER Kevin T. Fitzpatrick

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Jacket Water Stand Pipe - Supports

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-700B

REV. NO. 1

SNPS GPL NO. 00-700C

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52

REFERENCES (continued)

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet

Engine B

Same as Engine A

GROUP CHAIRPERSON _____ PROGRAM MANACER _____

COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for this evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-700B

Effective Printout Date 11/30/84

COMPONENT TYPE: JACKET WATER STANDPIPE-SUPPORTS (SMALL BORE SCOPE ONLY)

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
None		
NON-NUCLEAR		
None		

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Standpipe Switches

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-700D

TASK DESCRIPTION NO. DR-12-02-700D-0

SNPS GPL NO. 02-700E

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

A design review of the jacket water standpipe switch is not required for WNP-1 based on the following:

- A review of the DR/QR lead engine report (Comanche Peak).
- There is no WNP-1 site experience, nuclear or non-nuclear industry experience, listed in the EDG Component Tracking System for this component.
- Jacket water standpipe switches used at WNP-1 have the same manufacturer and model number as the jacket water standpipe switch used at Comanche Peak site. The switches are identified by TDI Part No. F-577-066 as Dwyer instruments, low differential pressure switch, Model No. 1823-40, with an operating range of 5 to 44 inches W.C.. The WNP-1 site differs from Comanche Peak in te number of switches installed on the jacket water standpipe. A pressure switch PS-37D (set point of 30 inches W.C.) is mounted 79 inches below the top flange on the jacket water standpipe controls solenoid valve (TDI Part No. YZ-015-000) on the demineralized water makeup supply to the standpipe. Pressure switch PS-37C (set point of 36 inches W.C.) is mounted 89 inches below the top flange on the jacket water standpipe and is used for alarming on low jacket water level.

  The Dwyer Instruments low differential pressure switch is compatible with the treated cooling water contained in the jacket water standpipe and the environment at the WNP-1 location. The design function of the jacket water standpipe switch is adequate for intended service at WNP-1.

There are no maintenance or modification recommendations required for the jacket water standpipe switches.

Quality revalidation for the jacket water standpipe switches is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

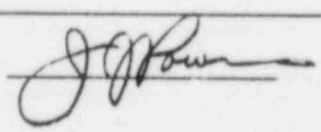
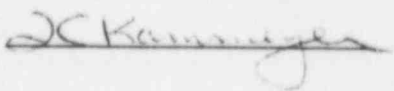
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Standpipe and Miscellaneous Bolting

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-700E

TASK DESCRIPTION NO. DR-12-02-700E-1

SNPS GPL NO. 03-700F

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review of this component for WNP-1 is not required based on the following:

- A review of applicable industry and site experience from the EDG Component Tracking System indicated that no experience items have been reported.
- The standpipe and installation at WNP-1 is very similar to that at Comanche Peak, which was previously reviewed and found acceptable. The two standpipes are very similar even though the WNP-1 standpipe is non-code and the Comanche Peak standpipe is ASME III.
- A detailed analysis was performed to seismically qualify the standpipe, Ref. 3.

A review of non-code jacket water standpipe design such as is utilized at WNP-1 has indicated that single sided fillet welds have been used on large bore jacket water, engine driven and auxiliary pump suction and engine return nozzles. This results in high stresses at weld roots which may lead to cracking of weld joints. As such the following inspection is applicable to this component:

- Visually inspect jacket water standpipe, pump suction and engine return nozzle welds each routine engine run and every 100 hours during extended engine runs. Any visible cracking or minor jacket water leakage should result in rework of nozzle welds at the next refueling outage.

There are no modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. TDI Drawings Nos. 101209, 101991 and 101419.

2. Specification 9779-53, Rev. 17, 11/17/81 "Diesel Generators" for the WPPSS Nuclear Project Nos. 1 and 4.

3. Seismic Qualification Report on Washington Public Power Supply System Nuclear Projects Nos. 1 and 4 Prepared by Structural Dynamics Research Corporation for Delaval Turbine Inc., Project Number 3815, Section III.8, Jacket Water Standpipe.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Carlon PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Auxiliary Sub-Base & Oil & Water Piping-Jacket Water: Valves

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717B

TASK DESCRIPTION NO. DR-12-02-717B-0

SNPS GPL NO. 03-717B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that which was addressed in the lead engine report. Site experience in the Component Tracking System involved valves received without documenation.
- A review of the lead engine DR/QR report (Comanche Peak).
- Similarity between WNP-1 and Comanche Peak components. Both have Powell valves; Figures 2342 check valve, 2491 gate valve and 2475 globe valves.
- WNP-1 jacket water system also contains a solenoid valve, manufactured by Automatic Switch Co. in the jacket water fill line. There has been no adverse industry experience with this valve.

The following maintenance recommednation from the lead engine DR/QR report should be implemented:

- Inspect the valves for packing leakage monthly.

There are no modifications recommended for this component, based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER J C Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Auxiliary Sub Base & Oil & Water Piping - Jacket Water: Pipe, Couplings, Fittings, Orifices and Strainers (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717C

TASK DESCRIPTION NO. DR-12-02-717C-0

SNPS GPL NO. 03-717D

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on a review of the applicable industry experience in the EDG Component Tracking System and the lead engine DR/QR report (Comanche Peak). There is no site experience listed in the Component Tracking System.

There are no maintenance recommendations for this component. However, the lead engine report does address site specific modifications to the skid piping and/or supports. Generic application of these modifications is not required for WNP-1 since the Comanche Peak modifications were made in order for the subject piping to meet the intent and philosophy of the ASME Code for the boundary conditions and assumptions used in the Owners Group analysis. These boundary conditions and assumptions may be somewhat different from those used in the manufacturer's analysis. Lead engine skid mounted large bore pipe modifications, as they apply to equipment nozzle loads, are addressed, if necessary, in the individual equipment design reviews.

Note that portions of the subject component are not installed. In order to validate the following connecting on-engine components, (02-435A&C and 02-436A&B), the uninstalled portions of the subject component are to be installed per TDI Detail No. 101-419.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Aux. Sub-base & Oil & Water Piping-Jacket Water: Pipe, Couplings, Fittings

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717C

TASK DESCRIPTION NO. DR-12-02-717C-0

SNPS GPL NO. 03-717D

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry and site experience listed in the EDG Component Tracking System.

There are no maintenance recommendations for this component. However, the lead engine report does address site specific additions of supports. The necessity for similar additions on WNP-1 has been assessed by a field walkdown.

The field walkdown was performed in accordance with the small bore piping criteria document (Ref. 1) and concluded that this component will perform its intended function for normal and earthquake loading provided that the supports are added/modified as indicated in DR/QR Report 02-717E.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTES TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Conlon PROGRAM MANAGER K. T. Fitzpatrick for JCK

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Aux. Sub Base & Oil & Water Piping - J. W.: Gaskets & Bolting

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-717D

REV. NO. 1

SNPS GPL NO. 03-717F

TASK DESCRIPTIONS

No further review of component 02-717D is required for the following reasons:

a) Component was reviewed on two lead engines with satisfactory results.

b) There is no significant industry experience and no site experience reported for this component.

GROUP CHAIRPERSON Victor A. Saleta PROGRAM MANAGER DC Kammayer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Auxiliary Sub-Base & Oil & Water Piping-Jacket Water: Supports (Large Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717E

TASK DESCRIPTION NO. DR-12-02-717E-0

SNPS GPL NO. 03-717G

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on a review of the applicable industry experience in the EDG Component Tracking System and the lead engine DR/QR report (Comanche Peak). There is no site experience listed in the Component Tracking System.

There are no maintenance recommendations for this component. However, the lead engine report does address site specific modifications to the skid piping and/or supports. Generic application of these modifications is not required for WNP-1 since the Comanche Peak modifications were not required for piping operability. The lead engine modifications were recommended in order for the subject piping to meet the intent and philosophy of the ASME Code for the boundary conditions and assumptions used in the Owners Group analysis. These boundary conditions and assumptions may be somewhat different from those used in the manufacturer's analysis. Lead engine skid mounted large bore pipe modifications, as they apply to equipment nozzle loads, are addressed, if necessary, in the individual equipment design reviews.

Note that portions of the subject component are not installed. In order to validate the following connecting on-engine components, (Nos, 02-435A, 02-435C and 02-436A&B), the uninstalled portions of the subject component should be installed per TDI Detail No. 101-419.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cuelogo PROGRAM MANAGER J C Kammeyer

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

AUXILIARY SUB-BASE AND OIL AND WATER
PIPING - JACKET WATER: SUPPORTS
(SMALL BORE SCOPE ONLY)
COMPONENT PART NO. 02-717E

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the structural adequacy of the auxiliary sub-base jacket water piping/tubing supports to withstand the effects of normal operating and earthquake loadings. The primary function of these supports is to provide adequate restraint of the small bore piping/tubing system in the intended support load direction.

II OBJECTIVE

The objective of this review was to perform an engineering evaluation of the small bore piping/tubing supports to assure that the component will perform its intended design function during normal operating and earthquake loadings.

III METHODOLOGY

In order to meet the stated objective, the following methods were used:

- The TDI Emergency Diesel Generator Component Tracking System was reviewed for the WNP-1 site, nuclear and non-nuclear industry experience. See Appendix C for results.
- The Quality Revalidation Checklist results were reviewed for acceptability.
- Both engines were partially assembled at the time of site inspection. This component was evaluated using actual walkdown information and by comparison to the Comanche Peak lead engine report.

Refer to the review procedures as described in Reference 1 for a detailed methodology of this evaluation.

IV RESULTS AND CONCLUSIONS

The small bore piping/tubing supports, as defined by this Component Design Review, have been evaluated in accordance with Reference 1 and have been found acceptable with modifications.

There are no Quality Revalidation Checklist results or TERs associated with this component.

Based on the above review and information contained in Reference 2, it is concluded that the supports will perform their intended design function at WNP-1 under all normal operating and earthquake loadings with the provision that the following recommended modifications be implemented as detailed in Reference 3:

Engines A and B

Installation of this component should be completed by the installation of restraints as shown on TDI Drawing 101419.

All U-bolts should be replaced with 3/8-inch diameter U-bolts having proper locking devices and installed to provide a proper sliding fit.

V REFERENCES

1. "Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 0.

2. Stone & Webster Calculation Number 11600.60-NP(B)-1201-XH

3. Memo No. 6596 from C. Malovrh/SWEC to J. Kammeyer/SWEC dated 12/21/84.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Auxiliary Sub-Base and Oil and Water Piping-Jacket Water: Supports

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717E

TASK DESCRIPTION NO: DR-12-02-717E-0

SNPS GPL NO. 03-717G

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Perform an engineering review of the small bore piping/tubing supports to provide additional assurances that the component will perform its intended design function during normal operating and earthquake loadings.

PRIMARY FUNCTION

Provide adequate restraint of the small bore piping/tubing system, in the intended support load directions.

ATTRIBUTE TO BE VERIFIED

Structural adequacy of small bore pipe/tube supports due to the effects of normal operating and earthquake loadings.

SPECIFIED STANDARDS

ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition, and all addenda thereto, including winter 1974.

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Delaval design documentation (specifications, calculations, drawings, etc.). In lieu of information from Delaval, the following information is required: verified support sketches and piping isometrics, material specifications, pipe size and schedule, and operating parameters (pressure, temperature, load combinations).

GROUP CHAIRPERSON John J Carlson PROGRAM MANAGER DC Kammeyer

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT: Aux. Sub. Base & Oil & Water Piping - Jacket Water: Supports

UTILITY: Washington Public Power Supply System, WNP-1

GPL NO. 02-717E

REV. NO. 3

SNPS GPL NO. 03-717G

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

2. Obtain sufficient data to support the design review effort. This may be accomplished by developing quality verified as-builts in accordance with Procedure DG-7, or by the Design Group performing a field walkdown.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

2. Information necessary for the design review effort.

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package

2. Review of detailed information by the Design Group

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52

2. Procedure DG-7

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet

2. Quality verified as-built isometric drawings for the supports if available from the Owner.

Engine B

Same as Engine A.

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.

2. The Design Group will be responsible for closing out this item. This can be done per Procedure DG-7 or by the performance of an engineering walkdown by the Design Group.

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON Viola A. Selch PROGRAM MANAGER DC Kammeyer

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-717E

Effective Printout Date: 11/30/84

COMPONENT TYPE: Auxiliary Sub Base and Oil and Water Piping - Jacket Water: Supports

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
10CFR50.55E filed concerning pipe supports not built to ASME III class NF as required.	Cleveland Electric DAR NO. 117 02/17/83	DR/QR reviews provide assurance that components will perform their intended design functions during normal operating and earthquake loadings. The utility is responsible to verify code compliance as required.
NON-NUCLEAR		
None		

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Jacket Water Heat Exchanger UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717N TASK DESCRIPTION NO. DR-12-02-717N-0

SNPS GPL NO. 10-103 CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that already addressed in the lead engine report. There was no site experience in the Component Tracking System.
- A review of the lead engine DR/QR report (Comanche Peak)
- The jacket water heat exchangers used at Comanche Peak and WNP-1 are both manufactured by Thermxchanger. The Comanche Peak heat exchanger is a single pass, and the heat exchanger at WNP-1 is a double pass. These heat exchangers are ASME III, Code Class 3.

The following maintenance recommendations from the lead engine DR/QR report should be implemented:

- Inspection of tubes and tube sheets for fouling, corrosion and tube damage, at each refueling outage.
- Periodic flushing of the heat exchanger and associated service water piping to prevent fouling and corrosion.
- Leakage through the packing that is visible can be eliminated by careful bolt adjustment to compress the neoprene packing. It is recommended that the packing rings be replaced and not reused if head removal is required, because of work hardening of the packing.

There are no modifications required based on the lead engine DR/QR report.

Quality revalidation is not required for this component.

COMPONENT DESIGN REVIEW CHECKLIST

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER JC Kammeyer

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Jacket Water Standby Heater Pump

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-717Q

REV. NO. 1

SNPS GPL NO. 10-107

TASK DESCRIPTIONS

No further review of component 02-717Q is required for the following reasons:

a) Component was reviewed on two lead engines with satisfactory results.

b) There is no industry experience for this component.

c) Type C component - Failure has little bearing on the effective use or operation of the D.G.

GROUP CHAIRPERSON *Victor A. Salete* PROGRAM MANAGER *[signature]*

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Auxiliary Jacket Water Pump

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-717T

REV. NO. 1

SNPS GPL NO. 99-810

TASK DESCRIPTIONS

No further review of component 02-717T is required for the following reasons:

a) Component was reviewed on the lead engines (Grand Gulf) with satisfactory results.
b) There is no site or industry experience reported for this component.
c) Class C Component - Component failure has little bearing on the effective use or operation of the diesel generator.

GROUP CHAIRPERSON Victor A Salata

PROGRAM MANAGER DC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Thermostatic Valves

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-810A

TASK DESCRIPTION NO. DR-12-02-810A-0

SNPS GPL NO. 03-515

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that previously addressed in the lead engine report. The thermostatic valve at WNP-1 was received without documentation and returned to TDI.
- A review of the lead engine DR/QR report (Comanche Peak)
- Both Comanche Peak and WNP-1 have AMOT Controls Corp. Model 8DAS valves.

The following maintenance recommendations from the lead engine DR/QR report should be implemented:

- Replace the thermal power element at 3 to 5 year intervals.
- Proper orientation of the valve should be verified by field inspection (i.e., exhaust ports should be centerline horizontal), if not, adequate vent lines must be installed).

No modifications are required pending results of above inspection.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER D C Kammeyer

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Misc. Equipment-Heater, Jacket Water

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-810B

REV. NO. 1

SNPS GPL NO. 03-800A

TASK DESCRIPTIONS

No further review of component 02-810B is required for the following reasons:

a) There is no pertinent industry experience in evidence.

b) Component was reviewed on lead engines (Shoreham). The following recommendations, made in the Shoreham DR/QR report should be followed by the Washington Public Power Supply System.

Preventive maintenance included in the TDI manual should be performed. Inspections scheduled at 18-month intervals should consist of the following.

- Measure heater insulation resistance and replace heater if degradation of insulation resistance is noted.
- Thoroughly clean heater element of deposits and inspect for signs of deterioration.
- Check calibration and inspect condition of thermostat and recalibrate or replace thermostat when necessary.

GROUP CHAIRPERSON Victor A Salet PROGRAM MANAGER J C Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Cylinder Heads	UTILITY Washington Public Power Supply System
GROUP PARTS LIST NO. 02-360A	TASK DESCRIPTION NO DR-12-02-360A-0
SNPS GPL NO. 03-360A	CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review is not required for this component based on review of the Phase I report and the reported applicable site and industry experience in the EDG Component Tracking System.

A review of TDI casting certificates revealed that all of the cylinder heads presently intended for use at WNP-1 were cast prior to October 1978. These cylinder heads are termed Group I as defined in the Phase I report. Although the Group I cylinder heads do not benefit from the manufacturing improvements implemented by TDI between October 1978 and September 1980, these cylinder heads have performed without problems at other nuclear plants for extended periods.

For increased reliability of the cylinder heads, the following maintenance items are recommended:

- Blow-over the engine after each operation of the engine to ensure against harmful effects of water leaks. In the event water is detected as a result of a cylinder head leak, the cylinder head should be replaced.

- Visually inspect the fuel injection port on each cylinder head for water leaks during the normal monthly engine run. If water leakage is detected, the cylinder head should be replaced.

There are no modification recommendations for this component, however, the following Quality inspections as delineated in the CQRC are recommended:

- Perform a liquid penetrant test of the valve seating surfaces.

- Perform a magnetic particle test on the fire deck area excluding the valve seating area.

- Determine the thickness of the fire deck area by ultrasonic testing.

Note: These inspections should be performed on a 100% sample plan for both engines.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cooley PROGRAM MANAGER Kevin T Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Cylinder Head Valves: Intake and Exhaust Valves
UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-360B
TASK DESCRIPTION NO. DR-12-02-360B-0

SNPS GPL NO. 03-360B
CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the Comanche Peak and Shoreham DR/QR reports, which establish the acceptability of the cylinder head valves for their intended purpose.

- A review of site, nuclear and non-nuclear industry experience listed in the EDG Component Tracking System indicated that there had been no design related failures associated with this component. The cylinder head valves are identical on all the Owner's Group TDI diesel engines (TDI Part No. 03-360-02-0D).

The primary nuclear and non-nuclear industry experiences associated with this component have been chrome plate flaking, scuffing, and scoring, and exhaust gas blowby due to lack of concentricity of the valve and seat. Because of the small number of hours nuclear service diesels are expected to operate between inspections, this will not noticeably affect engine performance.

There are no modifications recommended for this component.

The following Quality revalidation inspection recommendations are made to ensure proper component performance and quality and should be performed on both engines:

- Perform a visual inspection to verify adequate valve seating. There should be a uniform linear metallic ring on valve ring.

- Perform a visual examination of the valve and valve ring for scuffing and erosion on valve ring or valve seat area.

- Perform a dimensional check of the valve to valve guide clearance.

- Perform a visual examination of the valve stems and the top of the valves at the rocker arm contact area for scuffing or scoring.

- Perform a liquid penetrant test on the blended radius of the stem head for cracking.

The valve inspections outlined in the lead engine DR/QR reports also apply to the engines at WNP-1. The inspection should be performed for all new or reworked cylinder heads after an initial 500-600 hours of operation:

- Remove the subcover bonnet an inspect the interior for soot, which indicates valve blowby. Corrective action should be taken if this condition is found to exist.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Cylinder Head and Valves: Bolting And Gaskets

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-360C

TASK DESCRIPTION NO. DR-12-02-360C-0

SNPS GPL NO. 03-360C

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry experience. There is no site experience in the EDG Component Tracking System for this component.

There are no modification or maintenance recommendations for this component.

The following Quality Revalidation inspections should be performed on all station engines:

- Verify that the proper gaskets are installed in accordance with specification requirements;
- Perform a visual inspection of the gaskets for signs of distress.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Cylinder Head and Valves: Springs and Retainers

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-360D

TASK DESCRIPTION NO. DR-12-02-360D-0

SNPS GPL NO. 03-360D

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the Comanche Peak and Shoreham DR/QR reports, which establish the acceptability of the valve spring and retainer for their intended purpose.

- A review of the nuclear and non-nuclear industry experience listed in the EDG Component Tracking System indicated that there had been no design related failures associated with this component. The valve springs are identical on all the Owners Group TDI diesel engines (TDI Part No. 03-360-02-0M).

There have been several non-nuclear experiences where improperly shot peened springs were installed on some TDI engines. These springs failed during service and in some cases caused engine damage. The Quality inspections recommended below will verify that no detective springs are installed in the engines at WNP-1.

There are no modification or maintenance recommendations for this component.

The following Quality revalidation inspection is made to ensure component quality and should be performed on both engines.

- Visually inspect and document the color code of the valve springs. There should be no grey springs with brown stripes.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON J J Powers PROGRAM MANAGER R C Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Cylinder Head Covers: Subcover Assembly

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-362A

TASK DESCRIPTION NO. DR-12-02-362A-0

SNPS GPL NO. 03-362A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of applicable industry and site experience and the lead engine DR/QR reports (Shoreham and Comanche Peak).

There are no modification recommendations for this component.

The following Quality Revalidation inspections are recommended to assure component quality and apply to both engines:

- Perform a visual inspection on the web area of the subcover assembly and examine for indications of cracking (four per engine).
- Perform a liquid penetrant test of the subcovers on the machined surfaces of the rocker shaft assembly bolt boss (pedestal) for evidence of linear indications.

Quality inspections conducted at Catawba and Comanche Peak identified several cracked subcover pedestals. The majority were located near the intermediate rocker arm assembly. The pedestals here are counterbored 1/2 inch deep to accept hollow dowels (bushings) that keep the rocker arm shafts from moving laterally under the loads generated by the connector pushrods. The reported pedestals each had a tight crack running down through the web between the counterbore and the machined surface. This type of cracking could be initiated by improper disassembly/assembly of the rocker shaft or an excessive interference fit between the rocker shaft dowel and the subcover pedestal counterbore (TDI drawings specify a clearance of .000 to .0015 inch). Metallurgical examination indicates that the crack, once initiated, may propagate by fatigue.

Although there is no documentation of engine failure directly attributed to cracked subcover pedestals, cracks that extend into the threaded portion of the hole for the rocker arm capscrews could cause a decrease in bolt torque. To prevent this possibility, the following inspection is recommended:

- Perform a liquid penetrant test on the top and vertical machined surfaces of the subcover pedestals (connector pushrod side only) for signs of cracking at the counterbores.

This inspection is to be performed in conjunction with the rocker arm bushing inspections when the rocker arm shafts are removed from the subcovers. Subcovers with pedestal cracks that extend through the counterbore web down to the threads should be replaced. This inspection is to be performed at major engine overhauls (5 years).

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Oil Drip Tank Assembly UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 00-621A TASK DESCRIPTION NO. DR-12-02-621A-0

SNPS GPL NO. 99-621A CLASSIFICATION TYPE C

TASK DESCRIPTIONS

Design review for this component is not required based on following:

- A review of applicable industry experience from the EDG Component Tracking System that no significant experience items have been reported. No experience items from the Component Tracking System have been reported at WNP-1.
- The fuel oil drip tank used at WNP-1 is similar to that used at Comanche Peak. The Comanche Peak fuel oil drip tank was reviewed in detail and was found to have substantial design margins.

There are no maintenance or modification recommendations for this component.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. TDI Drawing Number 00-621-01-AP Fuel Oil Drip Tank (Comanche Peak) and 101195 (WPPSS).

2. SWEC Calculation No. 11600.60-NM(B)-001-CZC-041 "Design Review of the Fuel Oil Drip Tank - Comanche Peak."

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER J C Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Injection Equipment: Fuel Injection Tips UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-365B TASK DESCRIPTION NO. DR-12-02-365B-0

SNPS GPL NO. 03-365B CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that previously addressed in the lead engine report. There was no site experience listed in the Component Tracking System.
- A review of the lead engine DR/QR reports (Shoreham and Comanche Peak).
- The fuel injection nozzle assembly used at WNP-1 is identical to that used at Shoreham and Comanche Peak (i.e. Bendix, Type H4L-400, Holder No. 10-328850-5, Tip No. 10-84802-29).

The following maintenance recommendations from the lead engine DR/QR report should be implemented.

- TDI SIM Nos. 107 and 108 should be incorporated in the WNP-1 maintenance procedures.
- At each refueling outage, it is recommended that each assembly be disassembled, inspected, cleaned, and reassembled. At this time, each assembly should be pop tested and have the spray pattern checked.

No modifications are required for this component based on the lead engine report.

Quality revalidation is not required for this component.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Injection Equipment: Fuel Injection Pump

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-365A

TASK DESCRIPTION NO. DR-12-02-365A-0

SNPS GPL NO. 03-365A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that previously addressed in the lead engine report. There was no site experience in the Component Tracking System.
- A review of the lead engine DR/QR reports (Shoreham/Comanche Peak).
- The fuel injection pump used at WNP-1 is of the same manufacturer and type as that used at Shoreham & Comanche Peak (i.e., Bendix, Type FDXE-26, No. 10-375636-5).

The following maintenance from the lead engine DR/QR report should be implemented:

- Remove the pressure screw from each injection pump, check for erosion & reassemble during each outage.
- Disassemble, inspect, test and reassemble one pump at alternate refueling outages. Based on the results a decision can be made regarding the necessity to examine the remainder of the pumps.

No modifications are required for this component, based on the lead engine reports.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER Dennis T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Injection Equipment: Fuel Injection Tips UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-365B TASK DESCRIPTION NO. DR-12-02-365B-0

SNPS GPL NO. 03-365B CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that previously addressed in the lead engine report. There was no site experience listed in the Component Tracking System.
- A review of the lead engine DR/QR reports (Shoreham and Comanche Peak).
- The fuel injection nozzle assembly used at WNP-1 is identical to that used at Shoreham and Comanche Peak (i.e. Bendix, Type H4L-400, Holder No. 10-328550-5, Tip No. 10-94802-29).

The following maintenance recommendations from the lead engine DR/QR report should be implemented.

- TDI SIM Nos. 107 and 108 should be incorporated in the WNP-1 maintenance procedures.
- At each refueling outage, it is recommended that each assembly be disassembled, inspected, cleaned, and reassembled. At this time, each assembly should be pop tested and have the spray pattern checked.

No modifications are required for this component based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cudlog PROGRAM MANAGER DC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Injection Equipment - Tube Assembly

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-365C

TASK DESCRIPTION NO. DR-12-02-365C-0

SNPS GPL NO. 03-365C

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the EDG Component Tracking System for applicable industry and site experience and the lead engine DR/QR reports (Shoreham/Comanche Peak).

The fuel oil injection lines transfer fuel from the high pressure fuel injection pumps to the fuel injectors for the engine cylinders. The injection lines experience the extreme pulsating pressure of the plunger operated injection pumps. For TDI nuclear standby diesel generators, the pressure pulses are 3 ksi minimum pressure to 14.5 ksi maximum pressure. It was determined from fracture mechanics and fatigue analyses that flaws on the inner surface of the tubing potentially cause fatigue failure of the tubing from pulsating fuel pressure (Ref. 1).

Industry experience indicates a number of fuel leakage incidents involving the high pressure fuel oil tube assemblies. Such incidents are related to either failures or loosening of attachment fittings during engine operation, or tube failures because of manufacturing flaws on the inner surface exceeding the critical limit.

All TDI fuel injection tubing is 1/2 in. SAE 1008 or SAE 1010 steel manufactured to identical specification and is suitable for nuclear standby diesel generator service (Ref. 1) when manufacturing flaws on the inner surfaces are below the critical limit.

The following maintenance recommendations for this component from the lead engine DR/QR report for Shoreham site should be performed monthly while the engine is operating:

- Inspect compression fittings at both ends of each fuel injection line.

There are no modification recommendations for this component.

TASK DESCRIPTION (continued)

The following Quality inspections should be performed on all station engines:

- Perform a visual inspection on the fuel injection equipment for signs of leakage.
- All high pressure fuel lines are to be examined by an eddy current test (Ref. 2).

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. Emergency Diesel Generator Fuel Oil Injection Tubing Qualification Analysis prepared for TDI Emergency Diesel Generator Owners Group April 1, 1984.
2. Failure Analysis Assoc. NDE Procedure 11.10 "Eddy Current Inspection Procedure - High Pressure Fuel Lines - Carbon Steel."

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John Cauley PROGRAM MANAGER J. C. Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Injection Equipment: Supports (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-365D

TASK DESCRIPTION NO. DR-12-02-365D-0

SNPS GPL NO. 03-365D

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak). There is no site or industry experience for this component in the EDG Component Tracking System.

There are no modification recommendations for this component.

The following routine maintenance is recommended for this component:

- A visual inspection of the support elastomer for signs of deterioration or degradation should be performed at each refueling outage. Any inserts found unsatisfactory should be replaced.

A field walkdown was performed in accordance with the small bore piping criteria document (Ref. 1) and indicates that this component will perform its intended function for normal and earthquake loading.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Cudlogan PROGRAM MANAGER K.T. Fitzpatrick for JCK

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Pump Linkage: Fuel Pump Control Shaft; Linkage Assembly & Bearings

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 03-371A&B

TASK DESCRIPTION NO. DR-12-02-371A&B-0

SNPS GPL NO. 03-371A&B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that already addressed in the lead engine report. There was no site experience identified in the Component Tracking System.
- A review of the lead engine DR/QR report (Comanche Peak).
- Component in WNP-1 are identical to those in the lead engine.

The following maintenance recommendations from the lead engine DR/QR report should be implemented:

- To maintain proper control shaft alignment, it is recommended that the oil cups be inspected and filled on a monthly basis.

No modifications are required for this component, based on the lead engine report.

The following Quality inspections should be performed:

- Inspect linkage and bearings for freedom of movement (to be performed on Engines A&B.
- Determine the hardness of the shaft (to be performed on Engine A or B).

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON PROGRAM MANAGER

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT 1

Fuel Pump Linkage: Linkage
Assembly and Bearing

COMPONENT PART NO.: 02-371B

See Component Part No.: 02-371A

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Pump Linkage: Automatic Shutdown Cylinder

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-413B

TASK DESCRIPTION NO. DR-12-02-413B-0

SNPS GPL NO. 03-371C

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the Comanche Peak and Shoreham DR/QR reports, which establish the acceptability of the shutdown cylinder for its intended purpose.
- A review of the EDG Component Tracking System indicated no significant applicable industry experience and no site experience.
- The applicable engine dimensions and operating parameters at WNP-1 are identical or very similar to those for the same component at Comanche Peak (lead engine).

There are no maintenance or modification recommendations for this component.

Quality revalidation review is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

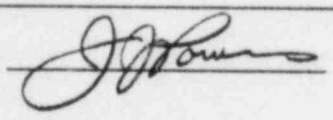
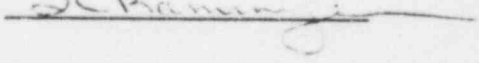
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Oil Booster Pump

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-445

TASK DESCRIPTION NO. DR-12-02-445-0

SNPS GPL NO. 03-445

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience. Site experience involved only an inspection of the fuel booster pump drive coupling, in accordance with TDI SIM 363.
- A review of the lead engine DR/QR report (Comanche Peak).
- Both Comanche Peak and WPPSS fuel oil booster pumps are Roper Model 18-AM-27, Type 1.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Oil Header: Piping/Tubing (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-450A

TASK DESCRIPTION NO. DR-12-02-450A-0

SNPS GPL NO. 03-450B

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak). There is no site experience for this component in the EDG Component Tracking System.

The review of applicable industry experience indicates that fuel oil line failures have occurred at Grand Gulf and Catawba. These failures were located at the tee connection on the fuel oil crossover header. Cause of failure has been attributed to vibration. A field walkdown was performed at WNP-1 in accordance with the small bore piping criteria document (Ref. 1). The walkdown indicated that a 1-inch threadolet was used as the method of connecting the 1-inch fuel oil supply tubing (branch side) to the 1-inch NPS front crossover header. This could result in stress concentration at the fitting-to-run pipe juncture, because of the abrupt change in wall thickness (fitting O.D. exceeds run pipe O.D.). Therefore, it is recommended that the 1-inch threadolet be changed to a socket welded tee to preclude the possibility of fatique failure from long term vibration stresses.

There are no maintenance recommendations for this component. However, the lead engine report does address site specific modifications supports. The necessity for similar modification on WNP-1 has been assessed by the above field walkdown.

The field walkdown concluded that this component will perform its intended function for normal and earthquake loading provided that the supports are added/modified as indicated in DR/QR report 02-450B and that the threadolet mentioned above is replaced with a socket welded tee.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTES TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Cadogan PROGRAM MANAGER K.T. Fitzpatrick for JCK

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

FUEL OIL HEADER - FUEL OIL SUPPORTS
(SMALL BORE SCOPE ONLY)
COMPONENT PART NO. 02-450B

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the structural adequacy of the fuel oil header tubing supports to withstand the effects of normal operating and earthquake loadings. The primary function of these supports is to provide adequate restraint of the small bore piping/tubing system in the intended support load direction.

II OBJECTIVE

The objective of this review was to perform an engineering evaluation of the small bore piping/tubing supports to assure that the component will perform its intended design function during normal operating and earthquake loadings.

III METHODOLOGY

In order to meet the stated objective, the following methods were used:

- The TDI Emergency Diesel Generator Component Tracking System was reviewed for the WNP-1 site, nuclear and non-nuclear industry experience. See Appendix C for results.
- The Quality Revalidation Checklist results were reviewed for acceptability.
- Both engines were partially assembled at the time of site inspection. This component was evaluated using actual walkdown information and by comparison to the Comanche Peak lead engine report.

Refer to the review procedures as described in Reference 1 for a detailed methodology of this evaluation.

IV RESULTS AND CONCLUSIONS

The small bore piping/tubing supports, as defined by this Component Design Review, have been evaluated in accordance with Reference 1 and have been found acceptable with modifications.

There are no Quality Revalidation Checklist results or TERs associated with this component.

Based on the above review and information contained in Reference 2, it is concluded that the small bore piping/tubing supports will perform their intended design function at WNP-1 under all normal operating and earthquake loadings with the provision that the following recommended modifications be implemented as detailed in Reference 3:

Engines A and B

Recirculation and Supply Headers, Right and Left Bank

- One of the eight required two-directional restraints on each engine bank should be revised to a three-directional restraint and located approximately mid-engine. The remaining two-directional restraints should be modified or shimmed as required to provide proper sliding fit.

Drip Return Risers, Header to Crossover

- The twisted flat bar/tube block supports partially installed on the risers should be deleted. New two-directional lateral/vertical restraints with increased structural properties should be installed on the horizontal offset of the risers. The use of multiple bolts when attaching to the engine is advised.

Fuel Oil Drip Return Headers

- The first restraint on the right and left bank fuel oil drip return headers at the governor end of the engine should be modified to a three-directional restraint to provide axial restraint of the headers.

- The existing U-bolts on the drip-header crossover piping should be replaced with 3/8 inch U-bolts and suitable locking devices. Installation should not restrict axial line movement while providing lateral restraint.

In order to support the small bore piping/tubing of component 02-450A, it is recommended that the following supports be added:

Fuel Oil Drip Return Headers

- A two-directional restraint should be added within twelve inches of the tee at the base of the right bank tubing riser running from the header to the drip tank (near the crossover piping). This is to provide axial restraint of the crossover piping.

Drip Return Header To Drip Tank

- The 1¼-inch tubing from the tee to the drip tank (not installed) should have two-directional restraints installed at 6-foot 0- inch maximum span intervals. Location of the restraints shall allow for thermal flexibility by providing a 6-inch minimum offset around bends.

Waste Lines From Drip Troughs

- The 3/4-inch tubing from the drip troughs was not installed at time of walkdown. Installation should incorporate two-directional restraints at a maximum span interval of 6-feet 0-inches. Location of the restraints and tube routing should account for differential expansion of the engine and tubing.

Engine Driven Fuel Oil Pump Suction And Discharge

- A two-directional restraint should be added to the suction and discharge tubing risers near pump at approximately mid-span.

- A two-directional restraint should be added at mid-span in the horizontal run on the suction tubing only.

Fuel Oil Filter To The Crossover Header

- A three-directional restraint should be added in the 45° skewed riser above the fuel oil filter.

Engine A

Fuel Oil Line From Cross Fitting To Fuel Oil Filter

- A two-directional restraint should be added at the same location as on Engine B.

V REFERENCES

1. "Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 0.

2. Stone & Webster Calculation Number 11600.60-NP(B)-1201-XH

3. Memo No. 6596 from C. Malovrh/SWEC to J. Kammeyer/SWEC dated 12/21/84.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Oil Headers and Fuel Oil Supports (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-450B

TASK DESCRIPTION NO: DR-12-02-450B-0

SNPS GPL NO. 03-450D

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Perform an engineering review of the small bore piping/tubing supports to provide additional assurances that the component will perform its intended design function during normal operating and earthquake loading.

PRIMARY FUNCTION

Provide adequate restraint of the small bore piping/tubing system in the intended support load directions.

ATTRIBUTE TO BE VERIFIED

Structural adequacy of the pipe/tube supports due to the effects of normal operating and earthquake loadings.

SPECIFIED STANDARDS

IEEE 387 ; ANSI B31.1,"Power Piping"

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1

DOCUMENTATION REQUIRED

Delaval design documentation (specifications, calculations, drawings, etc.).

In lieu of information from Delaval, the following information is required: verified support sketches and piping isometrics, material specifications, pipe size and schedule, and operating parameters (pressure, temperature, load combinations)

GROUP CHAIRPERSON John J Cochran PROGRAM MANAGER D C Kammerer

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Fuel Oil Header - Supports UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-450B REV. NO. 2

SNPS GPL NO. 03-450D

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

2. Obtain sufficient data to support the design review effort. This may be accomplished by developing quality verified as-builts in accordance with Procedure DG-7, or by the Design Group performing a field walkdown.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

2. Information necessary for the design review effort

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package

2. Review of detailed information by the Design Group

ACCEPTANCE CRITERIA (continued)

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52

2. Procedure DG-7

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet

2. Quality verified as-built isometric drawings for the supports if available from the Owner.

Engine B

Same as Engine A

GROUP CHAIRPERSON Steve M. Schmitz PROGRAM MANAGER K T Fitzpatrick

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COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.

2. The Design Group will be responsible for closing out this item. This can be done per Procedure DG-7 or by the performance of an engineering walkdown by the Design Group.

COMPONENT REVIEW (continued)

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON Victor J. Saleeba PROGRAM MANAGER K.T. Fitzpatrick

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-450B

Effective Printout Date 11/30/84

COMPONENT TYPE: Fuel Oil Header: Fuel Oil Supports

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
None		
NON-NUCLEAR		
None		

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Oil Filters & Strainers: Filters

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-455A

TASK DESCRIPTION NO. DR-12-02-455A-0

SNPS GPL NO. 03-455A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that previously addressed in the lead engine report. There was no WNP-1 site experience in the Component Tracking System.
- A review of the lead engine DR/QR report (Comanche Peak).
- The fuel oil filters at WNP-1 are the same model from the same manufacturer as those used at Comanche Peak. (Hilliard Model 511-150-1)

The following maintenance recommendations from the lead engine DR/QR report should be implemented:

- The filter differential pressure should be checked monthly and procedures should be established for replacing the filter cartridges at or before the manufacturers specified maximum of 25 psid.
- Air should be purged from the filters after maintenance.

There are no modifications required for this component, based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Oil Filters & Strainers: Filters

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-455A

TASK DESCRIPTION NO. DR-12-02-455A-0

SNPS GPL NO. 03-455A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that previously addressed in the lead engine report. There was no WNP-1 site experience in the Component Tracking System.
- A review of the lead engine DR/QR report (Comanche Peak).
- The fuel oil filters at WNP-1 are the same model from the same manufacturer as those used at Comanche Peak. (Hilliard Model 571-150-1)

The following maintenance recommendations from the lead engine DR/QR report should be implemented:

- The filter differential pressure should be checked monthly and procedures should be established for replacing the filter cartridges at or before the manufacturers specified maximum of 25 psid.
- Air should be purged from the filters after maintenance.

There are no modifications required for this component, based on the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cardoga PROGRAM MANAGER DC Hammergren

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Oil Filters & Strainers: Strainers

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-455B

TASK DESCRIPTION NO. DR-12-02-455B-0

SNPS GPL NO. 03-455B

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience, except that previously addressed in the lead engine report. There was no site experience.
- A review of the lead engine DR/QR report (Comanche Peak).
- Both WNP-1 and Comanche Peak use of Air Maze Model D3J24XDL, which provides 46 micron (300 mesh) filtration.

The following maintenance from the lead engine DR/QR report should be implemented:

- The strainer elements should be cleaned or replaced at 5 psid maximum ΔP.
- Air should be purged from the strainer after maintenance.
- Bolt torques of 120-150 in-lbs should be utilized during reassembly.

The following modification from the lead engine DR/QR report should be considered:

- The strainer can be replaced with a coarser design that would require less maintenance, but would still satisfy the filtration requirement for the booster pump, which is 100-200 mesh. This recommendation is made to enhance operation but is not required for system operation.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Oil Filters and Strainers Mounting Hardware

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-455C

TASK DESCRIPTION NO. DR-12-02-455C-0

SNPS GPI NO. 03-455C

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience. There is no site experience reported at WNP-1 in the Component Tracking System.
- A review of the lead engine DR/QR reports for Comanche Peak and Shoreham indicated substantial design margins.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Specification 9779-53, rev. 6, 1-27-77 "Diesel Generators" for the WPPSS Nuclear Project Nos. 1 & 4.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Aux. Sub-base & Oil & Water Piping-Fuel Oil: Piping and Fittings (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717J

TASK DESCRIPTION NO. DR-12-02-717J-0

SNPS GPL NO. 03-717M

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the review of the lead engine DR/QR report (Comanche Peak) and the applicable industry and site experience listed in the Component Tracking System.

There are no maintenance or modification recommendations for this component.

A field walkdown was performed in accordance with the small bore piping criteria document, (Ref. 1), and concluded that this component will perform its intended function for normal and earthquake loading provided that the supports are added/modified as indicated in DR/QR Report 02-717M.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTES TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON J. J. Cudoga PROGRAM MANAGER K. T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Auxiliary Sub-Base & Oil & Water Piping: Fuel Oil Valves

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717K

TASK DESCRIPTION NO. DR-12-02-717K-0

SNPS GPL NO. 03-717N

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated that there was no significant applicable industry experience other than that already addressed in the lead engine report. No site experience was identified in the Component Tracking System.
- A review of the lead engine DR/QR report (Comanche Peak).
- Both the lead engine and WNP-1 have Crosby relief valves, Models JO-25 and JR. WNP-1 engines also have Whitey shutoff valves, Model 1VM4-S4. There is no adverse industry experience with this valve and it has been used in other applications in nuclear plant emergency diesel engines.

The following maintenance recommendation from the lead engine DR/QR report should be implemented:

- Inspect and clean valves at each plant refueling outage.

There are no modifications required for this component.

Quality revalidation is not required for this component, however, an inspection should be performed to verify the relief valves have been installed in a vertical position per the manufacturer's recommendations.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadoga PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Auxiliary Sub Base - Oil & Water Piping - Fuel Oil: Bolting and Gaskets

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717L

TASK DESCRIPTION NO. DR-12-02-717L-0

SNPS GPL NO. 03-717P

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the review of applicable industry experience and the lead engine DR/QR reports (Shoreham/Comanche Peak). There is no site experience for this component in the Component Tracking System.

There are no maintenance or modification recommendations for this component.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON W. A. Carlson

PROGRAM MANAGER K.T. Fitzpatrick

WN3529/1

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT NO. 1

AUXILIARY SUB-BASE AND OIL AND WATER PIPING -
FUEL OIL: SUPPORTS
(SMALL BORE SCOPE ONLY)
COMPONENT PART NO. 02-717M

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project 1 (WNP-1) requires Design and Quality Revalidation reviews of the structural adequacy of the auxiliary sub-base fuel oil supports to withstand the effects of normal operating and earthquake loadings. The primary function of these supports is to provide adequate restraint of the small bore piping/tubing system in the intended support load direction.

II OBJECTIVE

The objective of this review was to perform an engineering evaluation of the small bore piping/tubing supports to assure that the component will perform its intended design function during normal operating and earthquake loadings.

III METHODOLOGY

In order to meet the stated objective, the following methods were used:

- The TDI Emergency Diesel Generator Component Tracking System was reviewed for the WNP-1 site, nuclear, and non-nuclear industry experience. See Appendix C for results.

- The Quality Revalidation Checklist results were reviewed for acceptability.

- Both engines were partially assembled at the time of site inspection. This component was evaluated using actual walkdown information and by comparison to the Comanche Peak lead engine report.

Refer to the review procedures as described in Reference 1 for a detailed methodology of this evaluation.

IV RESULTS AND CONCLUSIONS

The piping/tubing supports, as defined by this Component Design Review, have been evaluated in accordance with Reference 1 and have been found acceptable with modifications.

There are no Quality Revaildation Checklist results or TERs associated with this component.

Based on the above review, and information contained in Reference 2, it is concluded that the supports will perform their intended design function at WNP-1 under all normal operating and earthquake loadings with the provision that the following recommended modifications be implemented as detailed in Reference 3:

ENGINES A AND B

FUEL OIL BOOSTER PUMP SUCTION PIPING

- Installation of the restraint located on the piping riser above the connection to the supply header from the day tank should be completed in order to ensure that the lug that is welded to the pipe rests on the structural member. Through bolting in lieu of tapped holes is advised to eliminate the possibility of bottoming out bolts. The minimum size for the U-bolt should be 3/8 inch. All threaded fasteners should have suitable locking devices installed.

- The restraint located on the safety valve discharge bypass should have 3/8-inch diameter U-bolts with suitable locking devices installed. The U-bolt should be installed to provide two-directional restraint while not restricting axial movement.

DRIP RETURN PUMP DISCHARGE LINE

- The 1/4 diameter U-bolt should be replaced with a 3/8-inch diameter U-bolt with proper locking devices at the pump support structure. Installation should provide two-directional restraint while not restricting axial movement.

ENGINE A

SUPPLY TO ENGINE DRIVEN PUMP STRAINER

- The restraint attached to the pipe flange immediately upstream of the engine driven pump strainer should have longer flange bolts installed to ensure full thread engagement.

ENGINE B

FUEL OIL BOOSTER PUMP SUCTION PIPING

- The restraint located immediately upstream from the auxiliary duplex strainer should have a 3/8-inch diameter U-bolt with suitable locking devices installed. The U-bolt should be installed to provide two-directional restraint while not restricting axial movement.

FUEL OIL BOOSTER PUMP DISCHARGE PIPING

- The first restraint downstream of the fuel oil booster pump should have the existing U-bolt revised to 3/8-inch diameter and have suitable locking devices installed. The U-bolt should be installed to provide two-directional restraint while not restricting axial movement.

SUPPLY TO ENGINE DRIVEN PUMP STRAINER

- The restraint located on the horizontal pipe approximately 2-feet 8-inches north of the strainer and also supporting the 1 inch line from the booster pump should be modified to allow the installation of 3/8 inch diameter U-bolts (one per line) to act as two-directional restraints. Axial piping movement should not be restricted. U-bolts should have suitable locking devices installed. The damaged structural angle presently installed should be replaced.

In order to support the small bore piping/tubing of Component No. 02-717J, it is recommended that the following supports be added:

ENGINES A AND B

FUEL OIL INSTRUMENT AND VENT TUBING

- Two-directional restraints should be added at 4-ft 0-inch maximum span lengths on all auxiliary sub-base piping and equipment 1/4 inch tubing upon installation. Location of supports should consider thermal flexibility by providing a 6-inch minimum offset around bends.

ENGINE A

FUEL OIL BOOSTER PUMP SUCTION PIPING

- A restraint should be added immediately upstream of the auxiliary duplex strainer similar to Engine B (including modifications).

FUEL OIL BOOSTER PUMP DISCHARGE PIPING

- A restraint should be added downstream of the fuel oil booster pump, before the relief valve, similar to Engine B (including modifications).

- Add a restraint approximately 2 feet 8 inches north of the strainer similar to Engine B (including modifications). A two-directional restraint for the 1-inch line from the booster pump should be incorporated in this restraint similar to Engine B.

ENGINE B

FUEL OIL BOOSTER PUMP DISCHARGE PIPING

- A restraint should be added to the pipe flange immediately upstream of the engine driven pump strainer. Installation should be similar to Engine A (including modifications).

V REFERENCES

1. "Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 0.

2. Stone & Webster Calculation number 11600.60 NP(B)-1201-XH

3. Memo No. 6596 from C. Malovrh/SWEC to J. Kammeyer/SWEC dated 12/21/84.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Auxiliary Sub-Base and Oil and Water Piping-Fuel Oil: Supports (Small Bore Scope Only)

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717M

TASK DESCRIPTION NO.: DR-12-02-717M-0

SNPS GPL NO. 03-717Q

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Perform an engineering review of the small bore piping/tubing supports to assure that the component will perform its intended design function during normal operating and earthquake loadings.

PRIMARY FUNCTION

Provide adequate restraint of the small bore piping/tubing system, in the intended support load directions.

ATTRIBUTE TO BE VERIFIED

Structural adequacy of small bore pipe/tube supports to withstand the effects of normal operating and earthquake loadings.

SPECIFIED STANDARDS

ASME Boiler and Pressure Vessel Code, Section III, 1974 Edition, and all addenda thereto, including winter 1974.

REFERENCES

"Engineering Review Criteria Document for the Design Review of TDI Diesel Small Bore Piping, Tubing, and Supports for the TDI Owners' Group," Report No. 11600.60-DC-02, Revision 1.

DOCUMENTATION REQUIRED

Delaval design documentation (specifications, calculations, drawings, etc.). In lieu of information from Delaval, the following information is required: verified support sketches and piping isometrics, material specifications, pipe size and schedule, and operating parameters (pressure, temperature, load combinations).

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT: Aux. Sub-Base & Oil & Water Piping - Fuel Oil: Supports

UTILITY: Washington Public Power Supply System, WNP-1

GPL NO. 02-717M

REV. NO. 2

SNPS GPL NO. 03-717Q

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

2. Obtain sufficient data to support the design review effort. This may be accomplished by developing quality verified as-builts in accordance with Procedure DG-7, or by the Design Group performing a field walkdown.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

2. Information necessary for the design review effort

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package

2. Review of detailed information by the Design Group

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52

2. Procedure DG-7

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet

2. Quality verified as-built isometric drawings for the supports if available from the Owner.

Engine B

Same as Engine A

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT REVIEW

Engine A

1. No EDGCTS site experience documents are in evidence.

2. The Design Group will be responsible for closing out this item. This can be done per Procedure DG-7 or by performance of an engineering walkdown by the Design Group.

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 02-717M

Effective Printout Date: 11/30/84

COMPONENT TYPE: Auxiliary Sub-Base Oil & Water Piping-Fuel Oil: Supports

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
None		
NUCLEAR		
Supports omitted during assembly of fuel oil bypass lines	San Onofre 1 LER 206-77000, 770510	Implementation of all recommendations given in this DR/QR report will preclude the occurrence of this event at WNP-1.
10CFR50.55E filed, support not built to ASME III Class NF as required.	10CFR50.55E Cleveland Electric DAR No. 117 dated 02/17/83	DR/QR report provides assurance that components will perform their intended design function during normal operating and earthquake loadings. The utility is responsible to verify code compliance as required.

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Fuel Oil System - Fuel Oil Duplex Strainer

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-717W

REV. NO. 1

SNPS GPL NO. 99-825F

TASK DESCRIPTIONS

No further review of component 02-717W is required for the following reasons:

a) There is no site or industry experience reported for this component.
b) Component was reviewed on the lead engines (Shoreham - under Component 03-455B/Comanche Peak) with satisfactory results.

GROUP CHAIRPERSON Vita A Saleta

PROGRAM MANAGER D.C. Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Fuel Oil Day Tank

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 84-140

TASK DESCRIPTION NO. DR-12-84-140-0

SNPS GPL NO. 99-825A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

A detailed design review of the fuel oil day tank is not necessary at WNP-1 based on the following:

- No inherent flaws have been identified in TDI supplied fuel oil day tanks.
- A review of the lead engine DR/QR report (Comanche Peak).
- There are no significant industry or site experience items reported in the EDG Component Tracking System for this componet.

The tank was analyzed in detail by SDRC for seismic and normal operating loads including nozzle loads, and found acceptable. The SDRC analysis assumes a floor supported tank, i.e. there is no consideration of supporting bracket flexibility. During field walk-downs it was observed that the tank was supported off the floor. It is recommended that the rigidity of the tank support be confirmed. Note that the tank support is not TDI supplied.

No maintenance requirements were identified for this component in the lead engine design review.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. Specification 9779-53, Rev 17, 11-17-81 "Diesel Generators" for the WPPSS Nuclear Project Nos. 1 & 4" para 3.5.4.4

2. Seismic Qualification Report on Washington Public Power Supply System Nuclear Projects no. 1 and 4 prepared by Structural Dynamics Research Corporation for Delaval Turbine Inc., Project Number 3815, Section III.13 Fuel Oil Day Tank

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DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J Cadogan PROGRAM MANAGER JC Kammeyer

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT NO. 1

EMERGENCY DIESEL GENERATOR
COMPONENT PART NO. 84-101A

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the generator to determine its adequacy for its intended use at WNP-1. The primary function of the generator (AC Synchronous Generators, Serial Nos. 17512576/200 and 17512577/200, manufacturered by Electric Products Division, Portec, Inc.) is to supply all engineering safety features (ESF) and plant protection systems loads, in case of operation of the engineered safety features actuation system (ESFAS) and/or loss of offsite power (LOOP).

WNP-1 has two diesel generator sets to supply the ESF and plant protection system loads on the 4160-V emergency buses EA and EB. These sets are each rated 7060 kW continuous and are supplied by TDI.

II OBJECTIVE

The objective of this review was to verify the generator's ability to maintain emergency bus voltage under emergency loading conditions.

III METHODOLOGY

The maximum coincident demand on the diesel generators was compared with the continuous and short term ratings of the generator. NRC Safety Guide 9.0 (Ref. 1), Regulatory Guide 1.9 (Ref. 2), IEEE Standard 387-1977 (Ref. 3) and the WNP-1 Specification (Ref. 8) were reviewed regarding the ratings.

The sequential loading of the generators as specified in Reference 4 was examined. Using the generator parameters provided by Portec (Ref. 5), minimum generator voltage was computed for each step of the sequential load. Calculations (Ref. 6) were performed to verify that the minimum generator terminal voltage is in excess of 80 percent of the rated voltage. The qualification tests (Ref. 7) were reviewed to verify that the voltage recovers to 90 percent of the rated voltage in less than two seconds because of the action of the regulator.

WNP-1 site experience, as reported in Component Tracking System printouts, was reviewed. In addition, nuclear and non-nuclear industry experience was reviewed.

The design of the brush arrangement was reviewed for adequacy (Ref. 6). Comparison was made with the brush arrangement at Shoreham.

The generator maintenance program was reviewed with regard to brushes and slip rings (Ref. 9).

The procurement specification, 9779-53 (Ref. 8) was reviewed in the light of IEEE Standard 387-1977, NRC Regulatory Guide 1.9, and Safety Guide 9.0. Qualification tests (Ref. 7) were reviewed with regard to the test procedure imposed by IEEE Standard 387.

Quality Revalidation Checklist results were reviewed for acceptability.

IV RESULTS AND CONCLUSIONS

Examination of the sequential loading as specified in Reference 4 shows that the maximum continuous load will be 6893 kW, and the short-term load will be 7376 kW on each generator in the event of an ESFAS and a LOOP. Each generator has a continuous rating of 8825 kVA, 7060 kW at 0.8P.F., and a 10 percent overload rating for two hours. Therefore, it is concluded that the continuous and short-term ratings of each generator are adequate.

Calculations (Ref. 6) show that the minimum voltage of the generator during automatic sequencing in the event of an ESFAS and/or LOOP will not drop below 84.0 percent of the rated voltage. Qualification tests (Ref. 7) show that the generator terminal voltage recovers to 90 percent of the rated voltage within 0.22 seconds. Based upon the calculations and results of the qualification tests, the performance of the generator is acceptable with regard to the specified minimum voltage (80 percent of the rated voltage as per procurement specifications, Ref. 8) and recovery time.

WNP-1, nuclear and non-nuclear industry experience listed in the Component Tracking System was reviewed. The results of the review are given in Appendix C of this report. It was found that the incidents were not of a generic nature and do not impact the conclusions of this report.

Evaluation of the design of the brushes and brush holders at WNP-1 and comparison with those at Shoreham show that the brushes and brush holders were selected and designed adequately for both generators (Ref. 6).

No cases of failures of the brushes or slip rings have been reported at WNP-1. Maintenance procedures recommended by the manufacturer with regard to brushes and slip rings (Ref. 9) are adequate.

The procurement specifications (Ref. 8) reflect the relevant standards (Ref. 1, 2, and 3). Qualification tests comply with relevant standards (Ref. 3).

The information provided on TER 12-002 has been reviewed and is consistent with the final conclusions of this report.

Quality Revalidation Inspection results identified in Appendix B have been reviewed and considered in the performance of this design review, and the results are consistent with the final conclusions of this report.

Based on the above review, it is concluded that the emergency diesel generator is acceptable for its intended use at WNP-1.

V REFERENCES

1. NRC Safety Guide 9.0, "Selection of Diesel Generator Set Capability for Standby Power Supplies," dated 03/10/71.

2. NRC Regulatory Guide 1.9 "Selection, Design and Qualification of Diesel-Generator Units used as Standby (Onsite) Electrical Power Systems of Nuclear Power Plants," Rev. 2, December 1979.

3. IEEE Std. 387-1977, "Criteria for Diesel Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations."

4. Interoffice Correspondence between S. Rau (FaAA) and C. Kinsel (United Engineers and Constructors) dated 01/08/85.

5. Portec Generator Parameters.

6. Support Package FaAA-SP-84-6-45 (L).

7. Sequential Loading Tests, DeLaval Qualification Test, February 28, 1978, Para. 2.6.2.1.

8. Specification 9779-53, Diesel Generators, Washington Public Power Supply System, August 29, 1975.

9. Instruction for the Installation-Operation-Maintenance of Horizontal AC Synchronous Generators, SM-1177, Portec Inc., The Electric Products Division.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Emergency Diesel Generator

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 84-101A

TASK DESCRIPTION NO. DR-12-84-101A-1

SNPS GPL NO. 03-650A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Verify the adequacy of the continous and short-term rating to meet the worst case loads on the 4.16 kV ESF buses of 1E and 2E.

Verify that the drop in the generator terminal voltage during the sequential loading of the generator does not exceed the specified value as per relevant IEEE Standards and NRC Regulatory Guides.

Identify and resolve any recurrent patterns of component failure listed on the Emergency Diesel Generator Component Tracking System.

Verify the adequacy of the design of the brush arrangement and compare it with that at Shoreham Nuclear Power Station (SNPS).

Review the generator maintenance program with regard to brushes and slip rings.

Verify that the generator procurement specifications reflect the relevant NRC Regulatory Guides and IEEE Standards and that the shop tests are in compliance with the IEEE Standards.

Review the Quality Revalidation Checklist results for acceptability.

Review information provided on TERs.

PRIMARY FUNCTION

Supply all safety related electrical loads in the event of loss of offsite power.

ATTRIBUTE TO BE VERIFIED

Ability to maintain emergency bus voltage under emergency loading conditions.

SPECIFIED STANDARDS

ANSI Standard C50.10 "General Requirements for Synchronous Machines."

ANSI Standard C50.12 "General Requirements for Salient Pole Synchronous Generators."

IEEE No. 115 "Test Procedures for Synchronous Machines."

NEMA MG-1 "NEMA Standard for Motors and Generators."

IEEE 323 (General Guide for Qualifying Class I Electrical Equipment for Nuclear Generating Stations).

IEEE Std. 387-1977 (Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations).

REFERENCES

Diesel generator procurement specification.

DOCUMENTATION REQUIRED

Site information on the generator exciter including:

1. Manufacturers instruction, operation, and maintenance manual.
2. Diesel generator procurement specification.
3. Qualification test data.
4. Diesel generator onsite test data.
5. Single line diagram for emergency bus system.
6. Nameplate data for emergency bus loads.

Manufacturer's Information including:

1. Generator data sheet.

GROUP CHAIRPERSON Kevin T. Fitzpatrick PROGRAM MANAGER

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Generator

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 84-101A

REV. NO. 1

SNPS GPL NO. 03-650A

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.

Engine B

Same as Engine A

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package

Engine B

Same as Engine A

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package

Engine B

Same as Engine A

REFERENCES

Engine A

1. QCI No. 52

Engine B

Same as Engine A

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet

Engine B

Same as Engine A

GROUP CHAIRPERSON Victor A Saleta PROGRAM MANAGER JC Kammeyer

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COMPONENT REVIEW

Engine A

1. All EDGCTS site experience documents were assembled and reviewed with satisfactory results.

Engine B

Same as Engine A

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

Engine B

Same as Engine A

GROUP CHAIRPERSON Victor A Saleta PROGRAM MANAGER JC Kammeyer

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 84-101A

Effective Printout Date: 12/28/84

COMPONENT TYPE: Emergency Diesel Generator

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
Generator assembly for Engine 75084/2487 was installed on Engine 75084/2848, and the generator assembly for Engine 75084/2848 was installed on Engine 75084/2487.	NCR 1-BNCR-53-05	These assemblies are interchangeable. Document packages were revised to reflect this.
NUCLEAR		
When diesel generator A was started, a high pitch vibration was noted. Rotor pole cap was thrown clear of rotor.	LER Robinson 2, 261-70000 701207	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
Diesel generator failed to accept load. Cause was undersized generator leads.	SER St. Lucie 1, 12-80, 800317	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
Brushes looked white hot while running.	NPRDS Davis-Besse 1, 810318, Hit 24	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
EDG-1 slip ring repair.	NPRDS Davis-Besse 1, 810402, Hit 91	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
During test, generator stator high temperature alarm was received.	LER Prairie Island 1, 282-74000 740809	Equipment not made by TDI or Portec. No impact on the conclusions of this report.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
During electrical switching operations, the E1 diesel breaker to the Unit 3 emergency bus failed to close because linkage in the breaker cubicle elevator mechanism cell switch was bent.	EPRI Peach Bottom 3 062775 DG-E1	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
DG-E1 tripped on "A" phase differential relay after generator had been paralleled.	EPRI Peach Bottom 2 121977 DG-E1	False trip of protective relays. Does not concern the issues addressed in the report.
Short between one coil to stator caused by loose laminations.	EPRI Pilgrim 1, 101178, DG-1B	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
Diesel generator brush rigging damaged by arcing.	NPRDS Brunswick 2, 830203 Hit 212	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
480 V ground caused by grounded stator lead.	NPRDS 10CFR50.55E San Onofre 1, 760609, Hit 196	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
Engine reached full speed and unit breaker tripped. Cause: broken ring type lug in the CT circuit.	NPRDS Millstone 1 820913, Hit 179	Problems with relay circuit. Does not concern the issues addressed in the report. Equipment not made by TDI or Portec.
Detroit Edison experienced high vibrations on its diesel generator.	I&E FERMI, Notice 83-51, 05/26/83	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
Auxiliary generator drive pulley failed. Cause: Original weld failed.	NPRDS San Onofre 1, 760114, Hit 189	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
Failure of breaker to close caused by bent linkage.	NPRDS Peach Bottom 2 750627, Hit 187	Problem with circuit breaker. Does not concern the issues addressed in the report. Equipment not made by TDI or Porter.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
Diesel generator inoperable because of overheating of ventilation cowling	NPRDS Fitzpatrick, 830819, Hit 228	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
Diesel generator failed to accept load because of undersized exciter leads.	MP&L 83-024 10/22/83	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
Diesel generator inoperable because of overheating of ventilation cowling.	NPRDS Fitzpatrick, 820803, Hit 227	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
Generator stator coils burned.	Service Report TPC Nuclear Plant No. 3 Maanshan, dated 12/09/81 (File T-45)	Equipment not made by TDI or Portec. No impact on the conclusions of this report.
DG-1A lost excitation voltage to the generator field. Loss of the generator field automatically opened the diesel generator breaker. The auxiliary operator then manually triped the diesel. A GM-EMD Part No. 8283002 spring coil assembly that holds a generator brush in place vibrated loose.	Maine-Yankee 309-83040 821211	This is an isolated incident. Equipment not made by TDI or Portec. No impact on the conclusions of this report.
During surveillance testing, D-G E4 breaker failed to close.	Peach Bottom 2, 102175 DG-E4	Circuit breaker problem. Not related to the issues addressed in this report. Equipment was not made by Portec or TDI. No impact on conclusions of the report.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
NON-NUCLEAR		
One incoming line of generator suffered a cable lug failure that arced out and cracked an insulator in the generator terminal box.	Rafha/Saudi Arabia Telex from Bailey(TDI) to DeLaval HQ (File T-33)	Isolated incident. Failure does not impact the conclusions of this report.
Fatigue failure of generator terminal lug.	Rafha/Saudi Arabia. IOC from Bailey (TDI) to G. King (TDI) dated 5/12/81.	Isolated incident. Failure does not impact the conclusions of this report.
Beloit Power System, Sitka, Alaska, generator lost its field because a lead between collector rings and field coils shorted to rotor.	I & E Circular 80-23 Sitka, Alaska	Equipment not made by TDI or Portec. No impact on the conclusions of this report.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Generator: Shaft & Bearings UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 84-101B TASK DESCRIPTION NO. DR-12-84-101B-0

SNPS GPL NO. 03-650C CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- The design review of the lead engine at Comanche Peak established the acceptability of the generator shaft and bearing for their intended use.
- The generators at WNP-1 were compared to those at Comanche Peak. The shaft dimensions, material properties, and bearings are very similar or identical.
- The results of the TDI torsional analysis show that bearing reactions, bending moments, and torque loading are almost identical for Comanche Peak and WNP-1. A similar factor of safety can therefore be expected to exist between the Comanche Peak and WNP-1 generator shaft and bearing.
- A review of the EDG Component Tracking System indicates that there has been no design related problems associated with this component. There is no site experience listed for this component in the EDG Component Tracking System.

There are no maintenance or modification recommendations for this component.

Quality revalidation for this component is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Curlogan PROGRAM MANAGER K.T. Fitzpatrick for T.C.K.

TDI OWNERS GROUP

for

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
NUCLEAR PROJECT NO. 1

GENERATOR CONTROLS
COMPONENT PART NO. 84-121

I INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program for the Washington Public Power Supply System Nuclear Project No. 1 (WNP-1) requires Design and Quality Revalidation reviews of the generator controls (manufactured by Electric Products Division, Portec, Inc.), Part No. 72-11700-100, to determine the adequacy of the design for the intended use at WNP-1. The primary function of the generator controls is to provide field current for the generator and to regulate the voltage of the 4.16-kV emergency bus. This is accomplished by the static exciter, which is the subject of this report.

The static exciter consists of the following subcomponents:

- The diode bridge rectifier assembly and diverter silicon controlled rectifiers (SCRs), which together supply the field current.
- The voltage regulator, which controls the SCR firing circuits such that generator output voltage is maintained constant.
- The SCR firing circuits, which supply firing pulses to the diverter SCRs.
- The motor driven potentiometer, which is used to adjust the emergency bus voltage.
- The field flashing circuit, which ensures self-excitation of the generator.
- The power potential transformer (PT), current transformers (CTs) and linear reactors, which supply the required AC voltage to the rectifier bridge and SCRs.
- The min-max excitation limit circuit, which controls the minimum and maximum reactor power output when the generator is synchronized to the plant electric system.

The generator control cabinets, as discussed in this report, consist of a double depth set of cabinets, three cabinets wide. Two bridge rectifier assemblies and two gate firing modules are located in the right-front cabinet. The left-front cabinet contains the automatic and manual voltage regulators, the automatic and manual motor driven potentiometers, and the field flashing circuit. The power PT is located in the bottom of the right-rear cabinet. The power CTs and linear reactors are mounted in the left-rear and center-rear cabinets. For reference, the cabinet behind the left-front is designated left-rear. The center-front cabinet contains overcurrent relays and governor controls, which are not addressed in this report.

II OBJECTIVE

The objective of this review was to verify the adequacy of the design and construction of the static exciter for its intended use at WNP-1.

III METHODOLOGY

The Emergency Diesel Generator Component Tracking System (Ref. 1) was reviewed for industry experience, and the following subcomponents were identified for a detailed design review:

- The diode bridge rectifier assembly and the diverter SCRs.
- The voltage regulator.
- The motor-driven potentiometer.
- The field flashing circuit.
- Linear reactors in the power circuit.

Detailed design review calculations (Ref. 2) were performed for the above subcomponents. Specifically, calculations were made to verify the adequacy of the following:

- Continuous and surge current ratings of the diodes and the SCRs.
- The ratings of the components of the motor-driven potentiometer circuit.
- The ratings of the components of the field flashing circuit.
- Thermal design of the linear reactors.

The design of the voltage regulator was evaluated qualitatively (Ref. 2).

The generator control cabinets were inspected at WNP-1 in Richland, Washington, on December 18, 1984 (Ref. 3). Construction details, arrangement and mounting of the subcomponents of the static exciter were studied.

Recommendations for maintenance procedures or modifications were made to address the various design and construction deficiencies found in the above subcomponents of the static exciter.

Other failure incidents reported in the EDG Component Tracking System printouts not involving the above subcomponents were reviewed and the results are given in Appendix C of this report. Incidents not reported in the Component Tracking System printout are discussed in Section IV of this report.

Quality Revalidation Checklist results were reviewed for acceptability. Applicable TERs were reviewed.

IV RESULTS AND CONCLUSIONS

The Emergency Diesel Generator Component Tracking System does not list any incidents related to the operation of the generator controls at WNP-1. Other incidents reported in the EDG Component Tracking System not involving the subcomponents considered in this report were reviewed. The results are given in Appendix C of this report. It was found that the incidents were not of generic nature and do not impact the conclusions of this report.

Notification of a potential design deficiency in the relay logic circuits associated with the exciter field flashing circuit was received (Ref. 7). The potential deficiency pertained to overheating of exciter electronic components resulting from prolonged energizing of the field flashing resistor. During normal operation, the field flashing relay closes about one second after an engine start signal and opens when the generator output builds up to about 60 percent of rated voltage. During the time this relay is closed, usually around 2 to 5 seconds, the field is energized from the station battery through the field flashing resistor. This resistor, which dissipates 5000 to 7500 watts and is located adjacent to electronic components of the exciter, will generate excessive heat if energized for a prolonged period of time. In addition, the field flashing resistor itself can be damaged if energized for a prolonged period of time. Damage to the nearby electronic components under this condition could prevent the generator from performing its intended safety function.

Although the specific problem that prompted this notification was later determined to be unrelated to equipment design, it was found that an attempted start concurrent with certain diesel generator fault conditions could cause a prolonged period of field flashing resistor energization. Specifically, if the start sequence progresses to the point of closing the field flashing relay and the output voltage of the generator does not build up for any reason, the field flashing resistor will remain energized until the exciter is manually reset.

In order to prevent the occurrence of this condition at WNP-1, it is recommended that the design of these circuits be reviewed. If the potential for the subject overheating exists, all diesel generator starts (other than emergency starts) should be monitored to assure that an unsuccessful start does not result in a period of prolonged field flashing resistor energization. A manual reset of the exciter should be initiated if the resistor is energized for more than 10 seconds. Alternatively, a control logic modification could be implemented to produce the desire circuit operation.

Notification has been received regarding a potential problem with Multi-Amp, States Division terminal blocks manufactured between 1974 and 1976 (Ref. 5). It is recommended that WNP-1 inspect the generator control cabinets and, if found, replace these terminal blocks with a suitable substitute.

Notification has been received regarding an inadequately rated paralleling CT (Ref. 6). Reference 7 indicates that the CTs are to be replaced when construction is restarted.

The following inadequacies have been discovered as a result of this design review:

- The field flashing relay has not been properly selected for the application. The present relay is an ac contactor manufacturered by Allen Bradley (Model No. 702-DC-COG93A). The field flashing application requires contacts with a dc current rating, which the present relay does not have. In addition, the procurement specification (Ref. 8) requires that the relay operate with a coil voltage of 105 to 140, but the present relay is only rated for operation at 125 V. Detailed recommendations for the replacement of the field flashing relay are given in Attachment 1.

- It was not possible to identify the temperature range of the integrated circuits (ICs) in the voltage regulator during the site inspection. However, the specification requires operation over the temperature range of 10 to 95 degrees F (-23.2 to 35 degrees C). The common commercial temperature range for these ICs is 0 to 70 degrees C. In order to assure adequate operation, WNP-1 should verify that either 1) military temperature range (-55 to 125 degrees C) ICs have been used, or 2) cabinet heaters will maintain the temperature above 0 degrees C (center-front cabinet).

- Qualitative evaluation of the design of the voltage regulator indicates that although this subcomponent can perform its intended functions, several desirable features that ensure high reliability of performance have not been incorporated in the design. These features are power supply bypassing, coating of all adjustable potentiometer spindles with Glyptol lacquer, using MIL-style multi-turn sealed potentiometers, soldering ICs to the printed circuit (PC) board directly instead of mounting in sockets, using

double sided PC boards, conformal coating of the PC boards, and shielding signal leads. Also, the voltage regulator PC board is not enclosed. A metal enclosure would protect the PC board from contamination by dirt and protect it from stray electric and magnetic fields that could induce noise in the exciter circuits. Detailed recommendations to incorporate these features are made in Attachment 3 of this report. When the recommendations are implemented, the long-term reliability and performance of the voltage regulator will be enhanced. As the voltage regulator in its present state is adequate to meet its intended functions, implementation of the recommendations of Attachment 3 is left to the discretion of WNP-1.

Inspection of the subcomponents review in this report (Ref. 3) revealed the following construction and mounting inadequacies:

- The diodes and the SCRs of the bridge rectifier assembly are mounted on the heat sinks with tapped holes and no other mounting hardware. Manufacturer's recommendations require drilled holes, nuts and lock washers. Westinghouse, the manufacturer of the diodes and SCRs used in many of the other Portec exciters, specifically recommends against mounting with tapped holes.

- The generator control cabinets are inadequately ventilated.

- Diode and SCR connections are terminated with up to six lugs and one stud, contrary to wiring practice requirements in the procurement specification (Ref. 8).

The construction and mounting deficiencies listed above do not presently endanger the diodes and SCRs, but for continued safe operation, these deficiencies must be remedied to assure proper thermal and electrical contact with the heatsinks and to prevent loosening of the diodes and SCRs from vibration. Remedial measures in the form of maintenance procedures and modifications address the mounting and wiring deficiencies of the diodes and SCRs without requiring significant modification to the equipment. The recommendations of Attachment 2 involve remounting of the diodes and SCRs and redesign of the cable terminations.

Recommendations to remedy the design and construction deficiencies are organized as follows:

- Attachment 1 - the recommendations must be implemented prior to placing the engine in emergency standby service to provide adequate diode rating and to enable monitoring of the diodes and SCRs. Recommendations are also made concerning the field flashing relay, heatsink wiring, and voltage regulator and firing circuit printed circuit boards.

- Attachment 2 - the recommendations must be implemented at the first refueling outage of the plant, or earlier at the discretion of WNP-1. When these recommendations are implemented, the maintenance procedures in Sections IA, IB and IC of Attachment 1 will no longer be necessary.

- Attachment 3 - the recommendations should be implemented at the discretion of WNP-1 to enhance the long-term reliability and performance of the voltage regulator. These recommendations represent design changes to the equipment and would best be implemented by the manufacturer at the request of WNP-1.

The information provided on TER 12-002 has been reviewed and is consistent with the final conclusions of this report.

The results of the Quality Revalidation Inspections performed to date and identified in Appendix B of this report have been reviewed and considered in the performance of this design review and are consistent with the final conclusions of this report.

Based upon the above review, it is concluded that the generator controls are adequate for their intended use at WNP-1 if all the recommendations of Attachment 1 of this report are adopted. The recommendations of Attachment 2 of this report must be implemented at the first refueling outage of the plant or earlier at the discretion of WNP-1. When the recommendations of Attachment 2 are implemented, the recommendations in Sections IA, I3 and IC of Attachment 1 will no longer be necessary. Recommendations of Attachment 3 of this report may be implemented at the discretion of WNP-1 to improve the long-term reliability.

V REFERENCES

1. Component Tracking System printout of Washington Public Power Supply System Nuclear Project No. 1, Component Part. No. 84-121 dated 12/07/84.

2. FaAA design review support package SP-84-6-46 (k).

3. Alexander Kusko, Inc. Trip Report, Washington Public Power Supply System, dated 12/18/84.

4. Letter from Mr. R. W. Helmick of River Bend Nuclear Group to Mr. C. L. Ray of Duke Power Company dated 11/02/84.

5. Letter from Mr. R. B. Libbey of States Division to T. M. Jacob of Stone & Webster Engineering Corporation dated August 4, 1980.

6. Letter from Mr. H. A. Ashby of Portec to Mr. D. Galler of A. Kusko, Inc. dated 08/02/84.

7. Letter from Mr. D. W. Mazur of Washington Public Power Supply Systems to Mr. R. H. Faulkerberry of the NRC Region V dated 06/28/82.

8. Washington Power Power Supply System Spec. No. 9779-53 Rev. 17.

Attachment 1

Washington Public Power Supply System Nuclear Project No. 1
Maintenance and Modification Procedures - Generator Controls

I. BRIDGE RECTIFIER ASSEMBLY

The recommendations below pertain to both bridge rectifier assemblies, which are located in the right-front cabinet.

A. Diode Mounting

1. Monitor the maximum temperature attained by the diodes by placing a temperature-sensitive label on the most visible face of the hexagonal body of the diode.

2. The temperature-sensitive label should be of the type that permanently blackens when its temperature has been reached or exceeded.

3. The temperature rating of the labels should be 270 degrees F. Omega brand model BE-270 or equivalent (Ref. 1) is recommended.

4. The label should be inspected before and after each running of the emergency generator.

5. If the temperature label indicates that the specified temperature has been exceeded, perform an electrical test of the diode (Ref. 2), remove the diode from the heatsink and inspect the mounting threads of the heatsink and the diode. Replace the diode and the heatsink as required to ensure that proper mounting tightness, 360 in-lbs (Ref. 3) and thread condition are maintained.

B. SCR Mounting

1. Monitor the SCR maximum temperature as in I.A, steps 1-5 above.

2. Use Omega brand model BE-200 or equivalent (Ref. 1) for 200 degree F. indication.

3. Tighten to 300 in-lbs (Ref. 4).

C. Diode and SCR Heatsink Wiring

1. Coat the side of the lugs and mounting bolt for the lugs where more than two lugs are attached to a diode or SCR terminal or to a heatsink connection with Glyptol lacquer (Ref. 5).

2. Apply the Glyptol on a readily visible side so that relative motion of the lugs with respect to one another or with respect to the mounting bolt can be detected.

3. Inspect the connections after each monthly test of the emergency generator.

4. Retighten connections that appear to have loosened. Remove old Glyptol and reapply if connections are retightened.

D. Cabinet Ventilation

1. The left-front generator control cabinet must be ventilated so that the temperature in the cabinet does not exceed 35 degrees C (95 degrees F).

II. VOLTAGE REGULATOR PRINTED CIRCUIT BOARDS

The recommendations below pertain to the automatic and manual voltage regulators, which are located in the left-front cabinet.

A. Adjustment Potentiometers

1. Coat one side of the adjustment screw for each of the adjustment potentiometers on the printed circuit board of the voltage regulator with Glyptol lacquer.

2. If adjustments are needed, remove the Glyptol and reapply when the adjustment procedure is complete.

B. Printed Circuit Board

1. Replace any TO-5 (round package) integrated circuits (ICs) with their dual inline pin (DIP) equivalent. These circuits are RCA CA3094 (Ref. 6), RCA CA723T (Ref. 7) and National LM741 (Ref. 8).

2. During each monthly test, inspect the components mounted on the printed circuit boards. Check for cleanliness and proper mounting of components. Report any abnormal conditions to engineering for evaluation.

C Integrated Circuits

In order to assure adequate operation, WNP-1 should do one of the following:

1. Inspect the cabinets and verify that military temperature range (-55°C to 125°C) integrated circuits have been used, or replace the present integrated circuits with the appropriate military temperature range version.

2. Maintain the left front and right front cabinet temperature above 0 degrees C.

D. Spare Parts

1. It is recommended that an adequate supply of spare parts be maintained.

III. REMOTE GATE FIRING PRINTED CIRCUIT BOARDS

The recommendations below pertain to both gate firing circuit boards, which are located in the right-front cabinet.

A. Printed Circuit Board

1. During each monthly test, inspect the components mounted on the printed circuit boards. Check for cleanliness and proper mounting of components. Report any abnormal conditions to engineering for evaluation.

IV. FIELD FLASHING RELAY

These recommendations would best be implemented by the manufacturer at the request of WNP-1.

A. Relay Rating

1. Replace the FF relay (an ac contactor, Allen Bradley Model No. 702-DC-COG93A, Ref. 9) with an equivalent dc contactor rated as follows: coil voltage operating range, 105-140 V; contact voltage, 150 V dc; contact current, 100A dc (interrupting and continuous). It may be necessary to install a voltage reduction circuit to permit the use of a contactor with a conventional coil voltage range.

B. Relay Enclosure

1. The relay should be of the enclosed type to prevent particles of dirt from being deposited on the contacts.

C. Relay Logic

2. Review the design of the relay logic in the field flashing circuit to determine whether the overheating problem (discussed in the report) exists. If the problem exists, all diesel generator starts (other than emergency starts) should be monitored to assure that an unsuccessful start does not result in a period of prolonged field flashing resistor energization. A manual reset of the exciter should be initiated if the resistor is energized for more than 10 seconds. Alternatively, a control logic modification could be implemented to produce the desired circuit operation.

V. MIN-MAX EXCITATION LIMITER

1. At each refueling outage, remove the cover of the min-max excitation limiter enclosure and inspect the components. Check for cleanliness and proper mounting of the components. Report any abnormal conditions to engineering for evaluation.

VI. WIRING

A. Terminal Blocks

1. Verify that no Multi-Amp, States Division terminal blocks manufactured between 1974 and 1976 are installed in the generator controls cabinets.

2. Replace as needed with substitute suitable for Class 1E use.

VII. REFERENCES

1 1983 Omega Temperature Measurement Handbook, Omega Engineering, Inc., p. Q-5.

2. Portec Static Exciter Voltage Regulator Instruction Manual.

3. Westinghouse Power Semiconductor Manual pp S33-S34.

4. International Rectifier Data Sheet PD 3.018A.

5. Gerber Electronics Catalog, p. 585 - General Cement Production Bulletin.

6. Data Sheet-RCA Linear Integrated Circuits, Type CA3094.

7. Data Sheet-RCA Linear Integrated Circuits, Type CA723T.

8. Data Sheet-National Semiconductor Integrated Circuit, Type LM741.

9. Portec Dwg. D72-11700-710.

Attachment 2

Washington Public Power Supply System Nuclear Project No. 1
Recommendations for Design and Construction
Modifications - Generator Controls

I. BRIDGE RECTIFIER ASSEMBLY

The recommendations below pertain to both bridge rectifier assemblies, which are located in the right-front cabinet.

A. Diode Mounting

1. The diodes should be mounted on the heatsinks with drilled holes, nuts, and lockwashers, and tightened to the proper torque (Ref. 1).

B. SCR Mounting

1. The SCRs should be mounted on the heatsinks with drilled holes, nuts, and lockwashers, and tightened to the proper torque (Ref. 2).

C. Heatsink Connections

1. The bolted-on lug arrangement must be redesigned so that there are no more than two lugs on each bolt.

2. Heatsink anodizing must be removed in the contact areas of all bolts and bus bar studs.

3. Current-carrying surfaces of lugs must not be separated by washers or nuts.

II. MOTOR-DRIVEN POTENTIOMETERS

The recommendations below pertain to both motor driven potentiometers, which are located in the left-front cabinet.

A. 500 Ohm/25 W Resistor

1. The 500-ohm/25-watt resistor sould be replaced with a resistor rated for 50-W power dissipation. Calculations at the design limits of 140 V for the nominal 125-V battery voltage show that power dissipation is 15 watts. The 50-W rating was selected in accordance with rating guidelines for non-aging of components in IEEE 650-1979 (Ref. 3).

2. The resistor should be remounted so that it is not directly below the circuit board.

3. The section of the potentiomenter enclosure that contains the resistor should be modified to provide slots or vents that support free convection and air exchange.

III. REFERENCES

1. Westinghouse Power Semiconductor Manual pp R33-R34.

2. International Rectifier Data Sheet PD-3.018A.

3. IEEE 650-1979.

Attachment 3

Washington Public Power Supply System Nuclear Project No. 1
Modifications Recommended to Improve
Long-Term Reliability - Generator Controls

I. VOLTAGE REGULATOR

The recommendations below pertain to the automatic and manual voltage regulators, which are located in the right-front cabinet.

A. Circuit Design

1. Power Supply Bypassing

The purpose of power supply bypassing is to prevent AC noise voltage generated outside the voltage regulator circuit from interfering with its operation and to prevent voltage generated by the circuit itself from propagating in the circuit. Inspection of the PC board and the voltage regulator schematic shows that power supply bypassing has been almost completely neglected in the circuit design. The following modifications are recommended:

a. The power supply terminals of each individual integrated circuit (IC) should be bypassed with a 0.01 - 0.1 microfarad ceramic capacitor from its supply terminals to ground (Ref. 1). The high current buffers (U3, U5, U7, Portec Drawing No. D72-08300-710 Rev. D, Schematic-SVS Regulator with Paralleling) require bypassing capacitors of 0.1 microfarad so that transients will not get back to the ICs (Ref. 2).

b. In addition to the high frequency bypass capacitor, a large value capacitor (approximately 10 micro-farad) is recommended for voltage regulator op amp U1, Portec Drawing No. D72-08300-710, Rev. D (Schematic-SVS Regulator with Paralleling). This is because of the presence of CR31 and CR32.

2. Shielding and Routing of External Signal Leads

Shielding and proper routing of signal leads external to the PC board is intended to prevent electromagnetically induced noise voltages from entering the signal leads. This is done by using shielded signal leads and by routing the leads so as to maximize the distance between the signal and high current leads. These techniques have been neglected in the wiring of the voltage regulator. The following modifications are recommended:

a. Shielded signal leads should be used for the connections between the motor-driven potentiometer and the voltage regulator.

b. A high frequency bypass capacitor providing an in-circuit low frequency cutoff of no less than 1 kHz should be installed to reduce high frequency noise on the feedback signal without interfering with the feedback loop operation.

c. The leads for the SCR gate signals should be run in separate bundles away from the current carrying leads.

3. Current Feedback Signal

The purpose of the current feedback signal is to improve the closed loop response of the voltage regulator. The current feedback signal is derived from a sensing transformer that measures one of the diode currents in the bridge rectifier. The following modification should be made to improve the stability of the voltage regulator while providing the same performance.

Replace the single-phase current sensing circuit with a three-phase current sensing circuit. This requires the use of a three-phase sensing transformer and a three-phase bridge rectifier circuit on the PC board. Additional stability is provided by reducing the filtering requirements of the feedback signal, which are presently provided by a resistance-capacitance filter on the PC board.

B. Construction

1. Vibration Protection

Reliable mounting of components on the PC board and the proper selection of components is necessary to ensure that the voltage regulator can withstand the vibration encountered during seismic events, construction or maintenance. However, the design of the board does not appear to be adequate for these conditions. At a minimum, the following modifications should be made:

a. The eight integrated circuits on the PC board that are presently mounted in sockets should be soldered directly to the PC board (Ref. 3).

b. The voltage range and stability adjustment potentiometer (R4 and R5) are unsealed, one turn commercial grade devices. General recommendations in Reference 4 suggest that MIL style components should be used in such Class 1E applications. These potentiometers should be replaced with MIL style, sealed, multi-turn potentiometers to improve the reliability and stability of these components.

2. Printed Circuit Board Construction

It is essential that the PC board construction be suitable for the reliability, mechanical, environmental and electromagnetic requirements of the Class 1E application. The following modifications should be made to assure adequacy of the design.

a. The present PC board is a single-sided board (i.e., copper circuit on one side and components on the other). Double-sided PC boards are commonly used in noise sensitive applications and where high reliability is necessary. The extra copper layer provides additional bypassing of high frequency ac noise.

b. The PC board should be conformably coated as a final step in manufacturing. Conformal coating prevents humidity and airborne particles from affecting the operation of the circuitry.

c Components should be soldered directly to the PC board. If sockets are used, retaining mechanisms must be provided to hold the components in the sockets.

II. REMOTE GATE FIRING CIRCUITS

The recommendations below pertain to both gate firnig circuit boards, which are located in the right-front cabinet.

A. Construction

1. Vibration Protection

Reliable mounting of component on the PC board and the proper selection of components is necessary to ensure that the voltage regulator can withstand the vibration encountered during seismic events, construction or maintenance. However, the design of the board does not appear to be adequate for these conditions. At a minimum, the following modifications should be made.

a. The three integrated circuits on the PC board that are presently mounted in the sockets should be soldered directly to the PC board (Ref. 3).

2. Printed Circuit Board Construction

It is essential that the PC board construction be suitable for the reliability, mechanical, environmental and electromagnetic requirements of the Class 1E application. The following modifications should be made to assure adequacy of the design.

a. The present PC board is a single-sided board (i.e., copper circuit on one side and components on the other). Double-sided PC boards are commonly used in noise sensitive applications and where high reliability is necessary. The extra copper layer provides additional bypassing of high frequency ac noise.

b. The PC board should be conformably coated as a final step in manufacturing. Conformal coating prevents humidity and airborne particles from affecting the operation of the circuitry.

c. Components should be soldered directly to the PC board. If sockets are used, retaining mechanisms must be provided to hold the components in the sockets.

III. REFERENCES

1. Roberge, J. K., "Operational Amplifiers - Theory and Practice," p. 444, John Wiley & Sons, Inc., New York 1975.

2. Stout D., and M. Kaufman, "Handbook of Operational Amplifier Circuit Design," p. 3-27, McGraw-Hill Book Co., New York 1976.

3. "IEEE Trial-Use Guide for Class 1E Control Switchboards for Nuclear Power Generating Stations," IEEE Std. 420-1973, p. 8, Sec. 4.1.2.

4. "IEEE Standard: Criteria for Protecting Systems for Nuclear Power Generating Stations," IEEE Std. 279-1971, p. 8, Sec. 7.3.

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Emergency Generator Controls UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 84-121 TASK DESCRIPTION NO. DR-12-84-121-0

SNPS GPL NO. 03-650B CLASSIFICATION TYPE A

TASK DESCRIPTIONS

The design review of the generator controls focuses on the generator exciter. Specific steps to the design review are:

- Review the site experience reported in the EDG Component Tracking System.
- Contact site personnel to obtain additional background information on the exciter.
- Identify EDG Component Tracking System events that are related to the design of the equipment.
- Perform a site inspection to gather additional information on the construction, installation, operation, and environment of the equipment. These inspections constitute the quality revalidation effort for this component.
- The exciter is typically organized as three assemblies: 1) the bridge rectifier assembly, consisting of diodes and thyristors; 2) the voltage regulator consisting of one or more printed circuit boards; and 3) a motor driven potentiometer. Design review calculations are performed to verify the adequacy of these assemblies.
- Recommend maintenance procedures or modifications as needed to assure the adequacy of the exciter.
- Verify that all design related events listed in the Component Tracking System are addressed by the design review.
- Review information provided on TERs.

PRIMARY FUNCTION

Provides field current for the generator and regulates the generator AC output voltage.

ATTRIBUTES TO BE VERIFIED

Diodes in bridge assemblies: cooling, current and voltage rating.

Diode surge current ratings.

Bridge assembly construction and wiring.

Silicon controlled rectifier's in bridge assembly: cooling, current and voltage ratings.

Voltage regulator design and construction.

Motor driven potentiometer component ratings.

Potential tranformer's, current transformer's, and linear reactors: mounting and cooling

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SPECIFIED STANDARDS

Not required

REFERENCES

Diesel generator procurement specification.

DOCUMENTATION REQUIRED

Site information on the generator exciter including:

1. Manufacturers instruction manual.
2. Diesel generator procurement specification.
3. Diesel generator onsite test data.

Manufacturer's information including:

1. Electrical schematics for the exciter, all assemblies and sub-assemblies within the exciter.
2. A description of the exciter's circuit configuration.
3. Industry standard part numbers for all power handling components, integrated circuits and other parts purchased by the manufacturer.

DOCUMENTATION REQUIRED (continued)

4. Heat sink configurations for the major power semiconductors.

5. Design data for the power handling magnetic components.

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Generator - Generator Control

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 84-121

REV. NO. 2

SNPS GPL NO. 03-650B

TASK DESCRIPTIONS

Engine A

1. Assemble and review existing documentation.
2. Visually inspect the three phase voltage regulator to identify the specific components.
3. Visually inspect the voltage regulator bridge rectifier to check the method of bonding the diodes to the heat sinks.
4. Visually inspect the exciter to determine the wiring and construction method used.
5. Verify that no Multi-Amp, States Division terminal blocks which were manufactured between 1974 and 1976 are installed.

Engine B

1. Assemble and review existing documentation.
2. Verify that no Multi-Amp States Division terminal blocks which were manufactured between 1974 and 1976 are installed.

ATTRIBUTES TO BE VERIFIED

Engine A

1. Quality status of Component Document Package
2. Specific components of three phase voltage regulator
3. Method by which diodes were bonded to the heat sinks
4. Wiring and construction method used on exciter
5. Type of terminal blocks installed

ATTRIBUTES TO BE VERIFIED (continued)

Engine B

1. Quality status of Component Document Package
2. Type of terminal blocks installed

ACCEPTANCE CRITERIA

Engine A

1. Satisfactory Document Package

2-4. Review of inspection report by the Design Group

5. No Multi-Amp, States Division terminal blocks (1974-1976) are installed

Engine B

1. Satisfactory Document Package
2. No Multi-Amp, States Division terminal blocks (1974-1976) are installed

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REFERENCES

Engine A

1. QCI No.52

2-4. Approved Site NDE Procedures, TER# 99-014

5. Approved Site NDE Procedures, TER# 99-037

Engine B

1. QCI No.52
2. Approved Site NDE Procedures, TER# 99-037

DOCUMENTATION REQUIRED

Engine A

1. Document Summary Sheet

2-5. Inspection Report

Engine B

1. Document Summary Sheet

2. Inspection Report

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

COMPONENT REVIEW

Engine A

1. All EDGCTS site experience documents were assembled and reviewed with satisfactory results.

2-4. A trip report was received transmitting the results of the required inspections for both engines. The results were reported in TER# 12-002.

5. No inspection reports has been received which fulfills this requirement.

Engine B

1. All EDGCTS site experience documents were assembled and reviewed with satisfactory results.

2. No inspection report has been received which fulfills this requirement.

RESULTS AND CONCLUSION

Engine A

The Quality Revalidation effort with respect to this component, as outlined above, is complete. The results have been forwarded to the Design Review Group for their evaluation and conclusions in support of the final report.

RESULTS AND CONCLUSION (continued)

Engine B

Same as Engine A

GROUP CHAIRPERSON Vita J. Seleta PROGRAM MANAGER J.C. Kammeyer

EDG COMPONENT TRACKING SYSTEM: WNP-1 SITE, NUCLEAR AND NON-NUCLEAR INDUSTRY EXPERIENCE SUMMARY

COMPONENT NO. 84-121

Effective Printout Date: 12/07/84

COMPONENT TYPE: Generator Controls

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
The VAR transducers in each generator control panel were supplied with 100 V capacitors instead of the required 200 V capacitor. The transducers were returned for work by TDI.	1-BNCR-53-07 DLUE-93-5016	Problem has been addressed by UE&C/Washington Public Power Supply System. Incident does not pose a pattern of concern for WNP-1.
Design deficiency in application of Westinghouse ECT. Current transformer operated outside rated temperature.	10CFR50,55E Washington Public Power Supply System 12/15/81	A design change has been made. Replacement of CT to be carried out when construction is restarted. Does not pose a pattern of concern to WNP-1.
NUCLEAR		
Generator tripped because of failure of diode in voltage regulator motor operated potentiometer.	EPRI Pilgrim 1 073074 DG-1B Alco Engine Div.	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Deficiency in test procedure. New procedure developed.	LER North Anna 2 339-82013, 820308 Ser. 62-82, Fairbanks-Morse.	This incident is a result of operator error or a procedural problem and is not related to a design deficiency of the equipment.
Generator failed to excite or start up because of unused relay target.	Oyster Creek 219-78031, 781130, GM-EMD	Equipment was installed or wired improperly. Not a design related incident.
Problem with residual voltage relaying. New relay installed.	LER North Anna 2 339-82018, 820427 Fairbanks-Morse	This incident has no relationship to the design of the equipment at WNP-1.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-2 STATUS
WNP-1		
Faulty lead on generator monitoring instrumentation.	LER North Anna 2 339-80003, 800528 Fairbanks-Morse	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Generator did not pick up load. Worn brushes on motor driven potentiomenter.	LER Kewaunee 305-74000, 740719 NPRDS-Hit 232, GM-EMC	This incident has no relationship to the design of the equipment at WNP-1.
Generator failed to excite because of loose fuse holder in exciter	LER Calvert Cliffs 1 317-7700, 771010 Fairbanks-Morse.	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Generator tripped because of increase in main generator voltage.	LER Calvert Cliffs 1 318-78000, 780110 EPRI-NP-3933 6/82 Fairbanks-Morse.	This incident is a result of operator error or a procedural problem and is not related to a design deficiency of the equipment.
Operator caused mismatch between main generator and diesel generator. Generator tripped.	LER Millstone 2 336-77000, 771109 Fairbanks-Morse	This incident is a result of operator error or a procedure and is not related to a design deficiency of the equipment.
Generator tripped while running. Diodes failed.	LER Big Rock Point. 155-7000, 700806 Caterpillar	Failures in the bridge rectifier circuit are addressed in the report. Maintenance items and design changes are recommended.
Generator voltage could not be adjusted from the control room because of a loose fuse clip.	EPRI Pilgrim 1 032574 DG-1B Alco Engine Div.	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Generator voltage dropped while running. SCRs failed in voltage regulator.	Grand Gulf Report Number 83-024, 9/22/83 TDI	Failures in the voltage regulator are addressed in the report. Maintenance items and design changes are recommended.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
Generator tripped on start of RHR pump because of design error-1981 modification.	SER Quad Cities 1 78-82 6/22/82 GM-EMD	This incident has no relationship to the design of the equipment at WNP-1.
Potential logic problem noted during design review.	SER Palisades 59-82 8/27/82 Alco Engine Div.	This incident has no relationship to the design of the equipment at WNP-1.
Breaker failed to operate because of uncharged spring.	SER Fort St. Vrain 38-82 05/01/82 Caterpillar	This incident is a result of operator error or a procedural problem and is not related to a design deficiency of the equipment.
Design deficiency found, time delays being installed.	SER North Anna 1 55-80 11/14/80 SOER 81-10 Fairbanks-Morse	This incident has no relationship to the design of the equipment at WNP-1.
Offsite power not restored because of design error in breaker circuit. Design change made.	SER Almaraz 1 79-82, 10-13-81 SOER 83-6	This incident has no relationship to the design of the equipment at WNP-1.
Voltage regulator failed because of water leak.	EPRI Peach Bottom 2 012474-DC-4 Fairbanks-Morse.	This incident has no relationship to the design of the equipment at WNP-1.
Generator did not excite because of dirty relay contacts in FF circuit.	LER Dresden 2 237-75000, 750319 EPRI-NP-2433, 6/82 NPRDS-Hit 145, GM-EMD	Failures in the field flashing circuit are addressed in the report. Design changes are recommended.
Generator voltage spiked to greater than 5200 V because of bad solder joint on voltage regulator printed circuit board.	LER Zion 1 295-78002, 780103 EPRI-NP-2433, 6/82 Cooper-Bessemer.	Failures in the voltage regulator are addressed in the report. Design changes are recommended.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
Diesel tripped because of wrong frequency setting.	NPRDS Dresden 2 7707712 Hit 125 GM-EMD	This incident is a result of operator error or a procedural problem and is not related to a design deficiency of the equipment.
Generator voltage dropped to 3000 V and oscillated because of bad amplifier in voltage regulator.	LER Zion 2 304-79017, 790310 EPRI-NP-2433 6/82 Cooper-Bessemer	Failures in the voltage regulator are addressed in the report. Maintenance items and design changes are recommended.
Generator voltage oscillates between 3000-4000 V because of drift of voltage regulator stability circuit.	LER Zion 2 304-78041, 780517 EPRI-NP-2433 6/82 Cooper-Bessemer	Failures in the voltage regulator are addressed in the report. Maintenance items and design changes are recommended.
Generator voltage rose to 4300 volts and could not be lowered during test.	LER Zion 2 304-78005, 780106 EPRI-NP-2433 6/82 Cooper-Bessemer	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Voltage regulator failed because of miswound paralleling transformer.	Grand Gulf Report Number 83-024 9/22/83 TDI	Equipment was installed or wired improperly. Not a design related incident.
Generator failed to excite because of dirt in FF relays.	LER Peach Bottom 2 277-75000, 750428 EPRI-NP-2433 6/82 042818-DG E2 NPRDS-Hit 188 Fairbanks-Morse	Failures in the field flashing circuit are addressed in the report. Design changes are recommended.
No output voltage from generator. Ground short because of chafing of leads.	LER Zion 1 295 75000, 750118 EPRI-NP-2433, 06/82	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Generator paralleled out of phase. Diodes in regulator circuit failed.	NPRDS Pilgrim 1 780802, Hit 93 EPRI-08278 DG-1B Alco Engine Div.	This incident is a random failure and does not pose a pattern of concern for WNP-1.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
Generator tripped. Rectifier assembly failed.	NPRDS Salem-1 771104 Hit 85 Alco Engine Div.	Failures in the bridge rectifier circuit are addressed in the report. Maintenance items and design changes are recommended.
Generator failed because of inverter failure.	LER Cook 1 315-82076, 820823	This incident has no relationship to the design of the equipment at WNP-1.
Generator voltage cutout failed because of sticky relay contacts.	NPRDS Trojan 1 830418, Hit 259 GM-EMD	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Over-excitation alarm actuated on shutdown because of defective relay.	NPRDS Trojan 1 830268, Hit 260 GM-EMD	This incident has no relationship to the design of the equipment at WNP-1.
Following SCRAM, generator could not be put on bus because of failure of loss of excitation relay. Procedure revised.	EPRI Brunswick 2 021378 DG-1 Norberg	This incident is a result of operator error or a procedural problem and is not related to a design deficiency of the equipment.
Instrument inverter failed.	EPRI Zion 1 081179 Inv 114 DG-0	This incident has no relationship to the design of the equipment at WNP-1.
Generator tripped. Suspected bad potential transformer.	NPRDS Pilgrim 1 800 505 Hit 2 and 92 Alco Engine Div.	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Generator failed to field flash because of burned out rectifier.	NPRDS Quad Cities 1 770425, Hit 158 GM-EMD	Failures in the field flashing circuit are addressed in the report. Design changes are recommended.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
Generator overloaded because of operator error.	NPRDS Zion 2 760919, Hit 238 Cooper-Bessemer	This incident is a result of operator error or a procedural problem and is not related to a design deficiency of the equipment.
Generator did not excite because of failed coil.	NPRDS Brunswick 2 810629, Hit 211 Norberg	Failures in the field flashing circuit are addressed in the report. Design changes are recommended.
Generator field flashing relay failed on start up.	NPRDS Brunswick 1 820726 Hit 205 Norberg	Failures in the field flashing circuit are addressed in the report. Design changes are recommended.
Generator started because of false undervoltage condition. Generator failed to energize bus because of broken wire lug.	EPRI Brunswick 2 010976 DG-1 Norberg	Equipment was installed or wired improperly. Not a design related incident.
Generator failed to operate with proper voltage and frequency because of failed fuse.	EPRI Davis Besse 060478, DG-1-1 NPTDS Hit 90 GM-EMD	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Rectifier found to be disconnected. Repair made.	I&E Notice 83-51 Clinton NP 05/20/83 Louis-Allis	Equipment was installed or wired improperly. Not a design related incident.
Generator tripped because of shorted resistor in logic circuit.	NPRDS Brunswick 1 810708, Hit 204 Norberg	This incident has no relationship to the design of the equipment at WNP-1.
Generator field failed to flash because of dirty relay contacts.	NPRDS San Onofre 1 821123, Hit 262 TDI	Failures in the field flashing circuit are addressed in the report. Design changes are recommended.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
Voltage regulator did not control generator voltage because of failed source circuit breaker.	NPRDS Arkansas Nuclear 1 830413, Hit 269 GM-EMD	This incident has no relationship to the design of the equipment at WNP-1.
Generator did not respond to manual voltage control because of failed K-1 relay.	EPRI Zion 1 072274 DG 1A, B Cooper-Bessemer	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Relay burned up in control panel because of coil failure.	NPRDS Kewaunee 750730, Hit 233 GM-EMD	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Diesel generator tripped on overspeed because of SCR failure in inverter.	EPRI Cook 1 120976 DG-CD Worthington	This incident has no relationship to the design of the equipment at WNP-1.
Diesel generator failed to start because of faulty switch. Switch repaired.	LER Dresden 1 010-78013, 780304 EPRI-NP-2433	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Control circuit breaker tripped because of slow blow fuses.	LER Zion 1 295-80012, 800312 NPRDS Zion 1 800312 Hit 47 Cooper-Bessemer	This incident has no relationship to the design of the equipment at WNP-1.
Generator tripped because of shorted resistor in logic.	NPRDS Brunswick 1 810614, Hit 204 Norberg	This incident has no relationship to the design of the equipment at WNP-1.
Voltage regulator failed because of burned out SCR. SCR replaced.	LER MP&L: 83-140 GGNS DG Reliability Report 10/26/84	Failures in the voltage regulator are addressed in the report. Maintenance items and design changes are recommended.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
Blown PT fuse alarm because of CFVB relay malfunction.	NPRDS Arkansas Nuclear One 750423, Hit 264 GM-EMD	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Generator tripped lock out relay and loss of excitation relay because of blocking device.	LER Arkansas Nuclear 1, 313-81007-1, 810427 GM-EMD	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Generator tripped "not available" alarm. High maintenance caused vibrations. The vibrations caused differential relays of Phase A to C to trip.	EPRI Brunswick 2 0220679 DG 1	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Potentiometers in NGV relays defective.	Shoreham LER 322 78000, 780301 TDI	Vendor defect. Not related to components in review.
Generator did not respond to manual control. Regulator with dirty contact.	EPRI Zion 1, 072874, DG 1A and 1B.	Failures in the voltage regulator are addressed in the report. Maintenance items and design changes are recommended.
Voltage regulator board found defective during inspection.	NPRDS Arkansas Nuclear 1, 780130, Hit 226 GM-EMD	Failures in the voltage regulator are addressed in the report. Maintenance items and design changes are recommended.
Field breaker would not close. Failed field diode.	NPRDS Quad Cities 1, 771128, Hit 157 GM-EMD	This incident has no relationship to the design of the equipment at WNP-1.
Generator field failed to flash. Shorted capacitor in field flashing circuit.	LER Dresden 3, 249-77000, 770322 NPRDS Hit 149 GM-EMD	This equipment is not made by TDI. Failure of a similar capacitor in the WNP-1 system would not prevent the generator from field flashing.

EXPERIENCE	REFERENCE DOCUMENTS	WNP-1 STATUS
WNP-1		
Malfunction from a shorted selenium rectifier in the generator field circuit. Short was caused by buildup of dirt.	LER Dresden 2 237-76000, 760930 NPRDS Hit 123 EPRI-NP-2433 06/82 GM-EMD	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Generator field failed to flash. Shorted capacitor in field flashing circuit.	NPRDS Dresden 2 750405 Hit 146 GM-EMD	This equipment is not made by TDI. Failure of a similar capacitor would not prevent the generator from field flashing.
Generator tripped on overspeed. Fuse in clip unsprung causing poor contact.	NPRDS Browns Ferry 3 770919, GM-EMD	This incident is a random failure and does not pose a pattern of concern for WNP-1.
Diesel generator tripped on loss of field.	LER Indian Point 2 247-74000, 740315 Alco Engineering Div.	Insufficient information in reference documents for evaluation.
DG-E1 tripped on A-phase differential after paralleling with E12 4-kV bus. No problem found.	Peach Bottom 2 121977 EPRI DG-E1 Fairbanks-Morse	This incident is a random failure and does not pose a pattern of concern for WNP-1.
NON-NUCLEAR		
None		

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Control Panel Assembly Cabinet/System

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-500A

TASK DESCRIPTION NO. DR-12-02-500A-0

SNPS GPL NO. 03-500A

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Based on a review of the DR/QR report for Grand Gulf, a design review of the control panel assembly cabinet/system is not required for WNP-1.

There is no WNP-1 site experience listed in the EDG Component Tracking System. Nuclear and non-nuclear industry experience listed does not show any significant or generic problems associated with the type of electronpneumatic system used.

The application of the electronpneumatic control system used on WNP-1 to start, stop, operate, protect, and monitor the diesel is essentially identical to Grand Gulf design. The protective system used on WNP-1 provides an additional Group II trip on low lube oil pressure which is bypassed during emergency operation. The low-low lube oil pressure trip on WNP-1 is identical to the low lube oil pressure trip on Grand Gulf with regard to the application of the "two out of three" logic design providing an active trip during an emergency operation and trip setpoint.

There are no maintenance or modification recommendations for the control panel assembly cabinet/system.

Quality revalidation of the control panel assembly cabinet/system is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON [signature] PROGRAM MANAGER [signature]

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Control Panel Assembly Accumulator

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-500F

TASK DESCRIPTION NO. DR-12-02-500F-0

SNPS GPL NO. 03-500F

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Based on a review of the DR/QR lead engine report (Comanche Peak), a design review for the accumulators is not required for WNP-1.

There is no WNP-1 site or applicable industry experience listed in EDG Component Tracking System for this component.

The accumulators used on WNP-1 are identical to those used on Comanche Peak with regard to manufacturer and application.

There are no maintenance or modification recommendations for the accumulators.

Quality revalidation of the accumulators is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

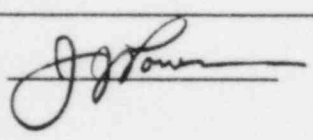
Not required

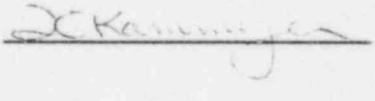
REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON 

PROGRAM MANAGER 

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COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Control Panel Valves
UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-500G
TASK DESCRIPTION NO. DR-12-02-500G-0

SNPS GPL NO. 03-500G
CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Based on a review of the lead engine DR/QR report for Grand Gulf, a design review for the control panel valves at WNP-1 is not required.

There is no WNP-1 site experience listed in the EDG Component Tracking System for the control panel valves. The nuclear and non-nuclear industry experience listed does not show any significant experience relating to the control panel valves.

The control panel valves used on WNP-1 are identical to those on Grand Gulf with regard to valve application and manufacturer, with the exception of Valvair 2-way valve F160-002. This valve is manually actuated at WNP-1 to provide local manual start capability and is of adequate design for this function.

To minimize fouling of the control panel valves, the valves should be inspected and cleaned, including the fine mesh screen in the check valves, during each refueling outage. This recommended maintenance interval should be reassessed depending upon the degree of system fouling.

There are no recommended modifications for the control panel valves.

Quality revalidation of the control panel valves is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON _____ PROGRAM MANAGER _____

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Control Panel Assembly Pressure Switches

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-500H

TASK DESCRIPTION NO. DR-12-02-500H-0

SNPS GPL NO. 03-500H

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Based on a review of the lead engine DR/QR report (Comanche Peak), a design review for pressure switches is not required for WNP-1.

There is no WNP-1 or non-nuclear industry experience listed in EDG Component Tracking System for this component. The nuclear industry experience listed does not show any generic or significant problems with the pressure switches.

The pressure switches used on WNP-1 are identical to those used on Comanche Peak with regard to manufacturer and application.

There are no maintenance or modification recommendations for the pressure switches.

Quality revalidation of the pressure switches is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

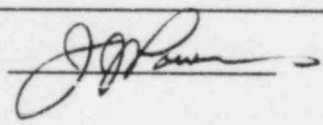
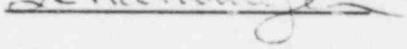
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Control Panel Assembly Control Relays

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-500J

TASK DESCRIPTION NO. DR-12-02-500J-0

SNPS GPL NO. 03-500J

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

Based on a review of the DR/QR report for Grand Gulf, a design review for the control relays is not required for WNP-1.

There is no WNP-1 site or non-nuclear industry experience identified in the EDG Component Tracking System. Nuclear industry experience listed showed that most of the experience items are not applicable to relay type, service condition, or are otherwise unrelated to TDI design, and therefore are not applicable to this component.

The application of the control relays used on WNP-1 to start/stop the diesel generator and to monitor its integrity is similar to Grand Gulf except for the use of Air Pax tachometer relay (TDI Part No. F-594-041). This relay is powered by 24V dc and is used in the field flash and bypassed shutdown circuitry. It is also used to provide a signal to indicate "running" and "ready to load" status. WNP-1 also uses an Allen-Bradley relay (TDI Part No. F-580-075) to provide a signal to the annunciator upon loss of 120VAC power. A review of the vendor's information for these relay's show that they meet design requirements.

There are no maintenance or modification recommendations for the control panel assembly control relays.

Quality revalidation of the control panel assembly control relays is not required.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

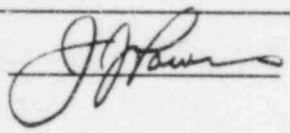
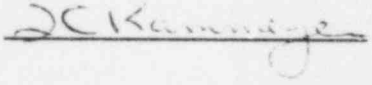
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Control Panel Assembly Solenoid Valves

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-500K

TASK DESCRIPTION NO. DR-12-02-500K-0

SNPS GPL NO. 03-500K

CLASSIFICATION TYPE A

TASK DESCRIPTIONS

A design review of the solenoid valves is not required for WNP-1 based on the following:

- A review of the DR/QR lead engine report (Comanche Peak).
- The control panel assembly solenoid valves used at WNP-1 are similar to those used at Comanche Peak with regard to manufacturer and application. The solenoid valves are identified for both sites as Humphrey Products, Model TO62E1-3-10-35-125VDC. TDI part numbers differ on WNP-1 from those assigned to control panel assembly solenoid valves for Comanche Peak site.
- The WNP-1 site control panel assembly solenoid valves employed for control of maintenance mode selection, return to operational, and stop functions are located on a Humphrey, three station, TM-3 manifold (Part No. 75084-128). The control panel assembly solenoid valves employed for control of shutdown system activate, shutdown system deactivate, field flash, D.C. power, running, and ready to load functions, are located on a Humphrey, six-station, TM-6 manifold (Part No. 75084-129) for the "A" circuit and a six-station, TM-6 Manifold (Part No. 75084-130) for the "B" circuit.
- The Circle Seal Controls solenoid valves, used as pilot valves for the California Controls Co. "Start Air Admission Valves" (TDI Part No. KR-001-000) in the starting air system at WNP-1, are similar to Comanche Peak design.
- There is no WNP-1 site experience or non-nuclear industry experience listed in the EDG Component Tracking System for this component. The nuclear industry experiences have been reviewed with regard to WNP-1 and no generic or significant problems are apparent.

There are no maintenance or modification recommendations required for the control panel assembly solenoid valves.

Quality revalidation for the control panel assembly is not deemed necessary.

PRIMARY FUNCTION

Not required

ATTRIBUTES TO BE VERIFIED

Not required

SPECIFIED STANDARDS

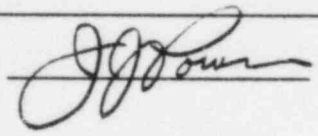
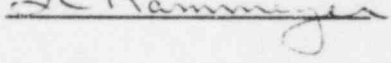
Not required

REFERENCES

Not required

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON  PROGRAM MANAGER 

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT: Control Panel Assembly - Piping, Tubing & Fittings

UTILITY: Washington Public Power Supply System, WNP-1

GPL NO. 02-500M

REV. NO. 1

SNPS GPL NO. 03-500M

TASK DESCRIPTIONS

No further review of component 02-500M is required for the following reasons:

a) Component was reviewed on two lead engines with satisfactory results.

b) There is no significant negative industry experience for this component.

GROUP CHAIRPERSON Victor A. Saleto

PROGRAM MANAGER JC Kammeyer

COMPONENT QUALITY REVALIDATION CHECKLIST

COMPONENT Control Panel Assembly Terminal Boards/ Switches, Wiring

UTILITY Washington Public Power Supply System, WNP-1

GPL NO. 02-500N

REV. NO. 1

SNPS GPL NO. 03-500N

TASK DESCRIPTIONS

Recommend that the following inspection for component 02-500N be performed:

- Verify that no Multi-Amp, States Division terminal blocks, manufactured between 1974 and 1976, are installed.

Any terminal blocks failing the above criteria should be replaced. Upon completion of the above verification, no further review of component 02-500N is required based on the following reasons.

a) Component was received on the lead engines (Shoreham) with satisfactory results.

b) There is no site experience or significant industry experience reported for this component.

GROUP CHAIRPERSON Victor A. Salata PROGRAM MANAGER JC Kammeyer

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Foundation Bolts - Anchor Bolts, Misc. Hardware

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-550

TASK DESCRIPTION NO. DR-12-02-550-0

SNPS GPL NO. 03-550

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

A design review report for this component for WNP-1 is not required based on the following:

- A review of applicable industry and site experience from the EDG Component Tracking System indicated that no significant experience items have been reported.
- The foundation bolting at WNP-1 is very similar to that at Comanche Peak, which was previously reviewed and found acceptable.
- Seismic accelerations are lower at WNP-1 than at Comanche Peak.

Items included in this component consist of the foundation bolts and associated hardware for the engine base, jacket water standpipe, auxiliary base, lube oil and jacket water coolers, keepwarm filter, generator and pedestal bearing, barring device, and starting air skid and tanks.

A review of the TDI Instruction Manual, Ref. 4, indicates that engine foundation bolt torque values are lower than those specified for Comanche Peak. The seismic environment is more favorable at WNP-1 than at Comanche Peak, and the lower specified bolt torques are judged adequate.

The lead engine report for Comanche Peak recommended retorque of the generator foundation bolts after a short circuit event as a part of the engine maintenance procedures. A review of References 3 and 5 indicates that the short circuit torque loads at the foundation bolts for WNP-1 are essentially the same as for Comanche Peak. Foundation bolt loads at Comanche Peak, due to the short circuit torque, were found to exceed the preload specified for the 1-⅛ inch foundation bolts. Consequently, it is recommended that either the bolts be retorqued to 600 ft.-lbs. or that after each occurrence of a short circuit event, the bolts should be retorqued to the originally specified 480 ft.-lbs. Additionally, the stator alignment should be checked after each short circuit event if the bolts have not been previously torqued to 600 ft.-lbs.

There are no modification recommendations from the lead engine report.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. Specification 9779-53, Rev. 17, 11/17/81 "Diesel Generators" for the WPPSS Nuclear Project Nos. 1 and 4.

2. Seismic Qualification Report on Washington Public Power Supply System Nuclear Projects Nos. 1 and 4 Prepared by Structural Dynamics Research Corporation for Delaval Turbine Inc., Project Number 3815.

3. SWEC Calculation Number 11600.60-NM(B)-001-CZC-029, "TDI Diesel Generator Foundation Bolt Review" (for Comanche Peak).

4. TDI Instruction Manual Vol. 1 and 2 Model DSRV-16-4, Diesel Engine/Generator Serial Numbers 75084-2847 through 76032-2881, Washington Public Power Supply System Nuclear Project Nos. 1 and 4, March 31, 1983.

5. Report of Seismic Analysis, 8825 KVA, 450 RPM Synchronous Generator Serial Number 17512576/577, Designed and Built by Electric Products Products Div., Portec Inc., Cleveland, Ohio, Rev. 1, Feb. 1975 WPPSS.

DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON J. J. Cudlogo — PROGRAM MANAGER Kenneth T. Fitzpatrick

COMPONENT DESIGN REVIEW CHECKLIST
WPPSS NUCLEAR PROJECT 1

COMPONENT Auxiliary Skid

UTILITY Washington Public Power Supply System

GROUP PARTS LIST NO. 02-717A

TASK DESCRIPTION NO. DR-12-02-717A-0

SNPS GPL NO. 03-717A

CLASSIFICATION TYPE B

TASK DESCRIPTIONS

Design review for this component is not required based on the following:

- A review of the EDG Component Tracking System indicated no significant applicable industry experience. There is no site experience reported in the Component Tracking System for this component.
- A detailed dynamic analysis was performed to seismically qualify the skid, Reference 2
- The auxiliary skid at WNP-1 has the same part number as the auxiliary skid used at Comanche Peak. The Comanche Peak auxiliary skid was reviewed and found acceptable. The Comanche Peak auxiliary skid did have some problems with ASME III-NF applicability and compliance. It was analyzed in detail by Gibbs and Hill, and the skid was accepted. Because WNP-1 uses fewer ASME III components, NF applicability to the auxiliary skid is not a problem.

There are no maintenance or modification recommendations for this component.

Quality revalidation is not required for this component.

PRIMARY FUNCTION

Not required

ATTRIBUTE TO BE VERIFIED

Not required

SPECIFIED STANDARDS

Not required

REFERENCES

1. Specification 9779-53, Rev 17, 11-17-81 "Diesel Generators" for the WPPSS Nuclear Project Nos. 1 & 4

2. Seismic Qualification Report on Washington Public Power Supply System Nuclear Projects no. 1 and 4 prepared by Structural Dynamics Research Corporation for Delaval Turbine Inc., Project Number 3815, Section III.7, Auxiliary Skid Base

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DOCUMENTATION REQUIRED

Not required

GROUP CHAIRPERSON John J. Codega PROGRAM MANAGER Kevin T. Fitzpatrick

TDI OWNERS GROUP

for

WPPSS NUCLEAR PROJECT 1

MAINTENANCE REVIEW
APPENDIX - II

I INTRODUCTION

The purpose of this Appendix is to provide WPPSS with a set of maintenance and surveillance recommendations for diesel generator components which have been developed by TDI and/or the Owners Group as a result of the overall Owners Group Program. This Appendix is intended to supplement the existing TDI Instruction Manual, Volume I and Volume III, which will maintain the qualification of the diesel generators for the life of the plant.

II METHODOLOGY

During the implementation of the Owners Group Program Plan, the Owners Group Technical Staff reviewed many sources of information regarding the maintenance and surveillance for the diesel generator components identified in this Appendix. These sources included TDI Instruction Manuals, Service Information Memos (SIMS), and TDI correspondence on specific components. This review along with Technical Staff input regarding the adequacy of the recommendations found in the sources mentioned above, and additional maintenance recommendations identified during the DR/QR review, forms the basis for the content of this matrix.

III RESULTS AND CONCLUSIONS

Proper maintenance is important in ensuring long, reliable and satisfactory service of the emergency diesel generators. Maintenance work, in order to be effective, must be carried out thoroughly and regularly. It is for these reasons that a detailed schedule of maintenance service has been laid out by the Owners Group for the TDI Diesel Generators at WPPSS Nuclear Project 1. The schedule details specific components requiring maintenance on a regular basis. This schedule separates the maintenance activities into daily, monthly, refueling outage, alternate outage (every other), 5-year and 10-year frequencies.

Those less significant diesel generator system components with which standard engineering practice and maintenance will ensure continued operation, are not specifically addressed in the matrix. Standard maintenance practices are briefly discussed below.

The engine and generator should be kept clean and dry at all times. Oil and water leakage should be wiped off the unit as quickly as possible in order to assist in locating the source of leakage, prevent potential equipment damage and maintain a safe working environment. Leaking pipes, gaskets and packing glands should be attended to promptly so as not to impair the reliability and/or operation of the system. Flanged gasketed connections may be retightened to stop leaks and any abnormal engine noises or vibrations. Actions required to correct any abnormal conditions should be carried out in a timely manner. Loose bolts and electrical terminals should be attended to in a safe, practical manner.

Specific items to be maintained on a DAILY basis consist of the following:

1. Observe and record lubricating oil and jacket water temperatures (keep warm pump running).

2. Drain all low point water collectors, barring device air filter and air receiver tank float traps in the air start system.

3. Check engine and auxiliary equipment and piping connections for oil, water, and fuel oil leaks.

4. Check level of lubricating oil in the governor and pedestal bearing. Add oil as needed.

5. Check fuel oil pump rack for freedom of movement through full limit of travel. Do not disconnect from governor.

6. Check turbocharger bearing lubricating oil system sight glass for oil flow.

7. Drain water from crankcase vent piping drip legs.

8. Verify all controls in proper position for standby mode.

9. Check all governor knob settings.

Load	Maximum Droop Zero
Speed	To provide mechanical governor control at 460 rpm.

10. Visually inspect lube oil heat exchanger and jacket water heat exchanger for signs of leakage from the lantern ring leakoff ports, indicating leaking packing rings.

The following Preventive Maintenance Recommendation Matrix was designed to assist the Maintenance Department in determining the scope of work required to maintain the intended design function of the diesel generators at WNP-1 on a planned schedule basis. It should be followed closely and referred to often.

WNP-1 MAINTENANCE MATRIX

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
F-068	Intercoolers	1. Evaluate heat exchanger performance by checking engine operating parameters.	X					
		2. Clean/inspect shell and tube sides every outage or as necessary.		X				Ref: Lead engine DR/QR Report #F-068 (Items 2, 3, 4)
		3. Visually inspect for external leaks.	X					Ref: 7/26/84 IOC from J. Cadogan to M. McGerigle, Ref: 08/14/84 letter to C. Ray from M. Lowrey
		4. The drain connection on the air intake system low point should be verified open and clean daily.						To be performed daily.
MP-022/3	Turbocharger	1. Measure vibration and check with base line data.		X				To be accomplished during 24 hour test run.
		2. Clean impeller and diffuser.		X				
		3. Measure rotor end play (axial clearance) to identify trends of increasing clearance, i.e; thrust bearing degradation.		X				Review thrust bearing axial clearances after inspection to determine if a trend exists. Any trend toward increasing axial clearance could signify thrust bearing degradation. Ref: Lead engine DR/QR Report #MP-022/3

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		4. Perform visual and blue check inspections of the thrust bearing.				X		NOTE: Thrust bearing inspection should also be performed after 40 non-prelubed (automatic) fast starts. Ref: Lead engine DR/QR Report #MP-022/3
		5. Disassemble inspect and refurbish.				X		
		6. Perform a spectro-chemical engine oil analysis to assist the bearing monitoring program. To further expand/clarify chemical analysis, ferrographic analysis may be utilized. Particular attention shall be paid to copper level, and particulate size, which could signify thrust bearing degradation.		X				To be performed during the last monthly test run prior to oil change. NOTE: Sample to be drawn up stream of lube oil filter. Ref: Lead engine DR/QR Report MP-022/3
SE-025	Full Pressure Lube Oil Strainer	1. Record strainer d/p.	X					Use for trend data
		2. Inspect and clean elements.						Inspect/clean when strainer differential pressure rises significantly. Ref: Lead engine DR/QR

Component Number	Component Identification	PM Recommendation		Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
									Report #02-820H, Ref: TDI Instruction Manual, Volume I, Maintenance Schedule
		3.	Lube oil strainer pressure gauge - calibration check.		X				
00-420	Lube Oil Pressure Regulating Valve	1.	Disassemble and clean.		X				If valve sticks repeatedly, more frequent cleaning may be necessary. If valve plugging becomes a problem, the dimensions of the valves' internal parts should be checked to ensure proper clearance. Ref: Lead engine DR/QR Report #00-420
		2.	During initial startup after a major reassembly of Lube Oil piping, the L.O. regulating valve should be disassembled and cleaned until abnormal L.O. pressure excursions subside.						
00-442A	Starting Air Distributor Assembly	1.	Visually inspect the poppet valve spool ends and timing cam of the starting air distributor.		X				Evaluate the degree of wear to determine whether existing condition would have an adverse effect on

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
								timing and the specified ability to start the engine.
		2. Ensure that the starting air manifold vent is open and unobstructed.	X					Ref: Lead engine DR/QR Report #00-442A (STAD), Items 1 & 2
02-305A	Base Assembly	1. Perform a visual inspection of the base. The inspection should include the areas adjacent to the nut pockets of each bearing saddle and be conducted after a thorough wipe down of the surfaces, using good lighting.		X				NOTE: Any cracks detected must be investigated furthe before the engine is allowed to return to service. Ref: Lead engine DR/QR Report #02-305B
02-305C	Main Bearing Caps - Studs and Nuts	1. Ur emoval of bearing lean mating es with a solvent to reassembly of the caps to the base.			X			Ref: Lead engine DR/QR Report #02-305C To be performed simultaneously with the main bearing shell inspection.
02-307B	Lube Oil Tubing and Fittings - Internal	1. Check tubing for dents or crimps.		X				Items 1, 2; Ref: TDI Instruction Manual, Vol. I, Maintenance Schedule
		2. Perform gear-train spray check.		X				

WNP-1 MAINTENANCE MATRIX

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-310A	Crankshaft	1. Measure crankshaft web deflection.		X				Complete TDI Inspection and Maintenance Record Form No. 310-1-1, TDI Instruction Manual, Volume I, Section 6. Ref: TDI Instruction Manual, Vol. I, Maintenance Schedule
		2. Measure diameter of crank journals.			X			Complete TDI Inspection and Maintenance Record Form No. 310-3-1, TDI Instruction Manual, Volume I, Section 6.
02-310B	Main Bearings Shells	1. Inspect and measure main bearing shell thickness. Inspection shall evaluate bearing wear and evidence of harmful crankshaft misalignment. If results show evidence of misalignment, TDI recommendations for crankshaft realignment should be implemented.			X			The first inspection should be performed at the first fuel outage and at alternate outages thereafter. Complete TDI Inspection and Maintenance Record Form No. 310-2-1, TDI Instruction Manual, Volume I, Section 6 - one sheet for each main bearing. Use Volume I, Appendix III for clearance values. Ref: TDI Instruction Manual, Vol. 1, Maintenance Schedule, Ref: Lead engine DR/QR Report #02-310B

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WNP-1 MAINTENANCE MATRIX

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-310C	Thrust Bearing Ring	1. Measure thrust bearing ring clearance via "bump check" method to be performed in conjunction with crankshaft web deflection measurements. The following information should be recorded: ° Date of inspection ° Hours of engine operation ° Hours of engine operation since last bearing replacement (Last bearing replaced: ____ forward _____ back) ° Bearing clearance		X				Complete applicable sections of TDI Inspection and Maintenance Record Form No. 310-1-1 TDI Instruction Manual, Volume I, Section 6. NOTE: If the clearance is greater than the maximum allowed in the TDI Instruction Manual, then at least one bearing must be replaced. Bearings should also be replaced if they are cracked or gouged. Ref: Lead engine DR/QR Report #02-310C, Ref: 8/13/84 memo from G. McCarthy to D. Pasquale
		2. Visually inspect thrust bearing ring for signs of cracks, gouges, wear or degradation.			X			To be performed simultaneously with main bearing shell inspection. Ref: Lead engine DR/QR Report #02-310C
02-311A	Crankcase Assembly	1. Perform a visual inspection of the vertical portion of the crankcase arch wall to the nut pocket area for indications of cracking.		X				The first inspection to be performed after 185 hours of at or near full load operation, may be used to justify the discontinuation of further inspect-

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
								tions. Ref: Lead engine DR/QR Report #02-311A
02-315A	Cylinder Block	1. Perform an inspection of the cylinder block per DR/QR Report #02-315A.						Ref: DR/QR Report #02-315A
02-315C	Cylinder Liners	1. Perform a visual inspection of liners for potential progressive wear.						Borescopic inspection is acceptable if heads are not removed. Complete TDI Inspection and Maintenance Record form No. 315-1-1, TDI Instruction Manual, Volume I, Section 6. Ref: Lead engine DR/QR Report #02-341B
02-317A	Water Discharge Manifold - Jacket Water Discharge Piping, Couplings and Seals	1. Visually inspect for leaks. Note: In the event of a leak developing in the the existing Dresser Style 65 couplings, these couplings should be replaced with Dresser Style 90 couplings equipped with Viton gaskets.	X					This recommendation is made on the basis that the maximum suggested operating temperature of 150°F for the Style 65 coupling may be exceeded. The maximum suggested operating temperature of the Style 90 is 212°F. Ref: Letter dated 12/13/84 from C L Ray to J George. Ref: DR/QR Report #02-317A&B.

WNP-1 MAINTENANCE MATRIX

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-340A/B	Connecting Rods, Bushings and Bearing Shells	1. Inspect and measure connecting rod bearing shells to verify lube oil maintenance which affects wear rate. The visual and dimensional inspection of the bearing shells should be conducted at the fuel outage which precedes 500 hours of operation by at least the sum of hours of operation in a LOOP/LOCA event plus the expected hours of operation between outages.						To be performed in conjunction with piston pin inspection. Complete TDI Inspection and Maintenance Record Form No. 340-1-1, TDI Instruction Manual, Volume I, Section 6, Appendix III for clearance values. Ref: Lead engine DR/QR Report #02-340B
		2. Inspect and measure the connecting rods.				X		Complete TDI Inspection Maintenance Record Form No. 340-2-1, 2, TDI Instruction Manual, Volume I, Section 6.
		3. Perform an X-ray examination on all replacement bearing shells to acceptance criteria developed by Owners Group Technical Staff.						This is to be performed prior to installation of any replacement bearing shells. Ref: Lead engine DR/QR Report #02-340B

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		4. Measure the clearance between the link pin and link rod in accordance with TDI-SIM #349. This clearance should be zero, i.e.; no measurable clearance when the specified bolt torque of 1050 ft-lbs is applied. This should be performed with the engine assembled after a major disassembly.						This recommendation is required one time only. Ref: Lead engine DR/QR Report #02-340A
		5. At major engine overhauls visually inspect the rack teeth surfaces for signs of fretting.				X		If fretting has occured a further engineering evaluation will be necessary. Ref: DR/QR Report #02-340A
02-341A	Pistons	1. Inspect and measure skirt and piston pin.				X		Complete TDI Inspection and Maintenance Report Form No. 341-1-1, TDI Instruction Manual, Volume I, Section 6. Use Volume 1, Section 8, Appendix III for clearance values. To be performed in conjunction with piston pin inspection.

WNP-1 MAINTENANCE MATRIX

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-341B	Piston Rings	1. Inspect and measure replacement piston rings.				X		Complete TDI Inspection and Maintenance Record Form No. 341-2-1, TDI Instruction Manual, Volume I, Section 6. Use Volume I, Section 8, Appendix III for clearance values. To be performed in conjunction with piston pin inspection.
		2. Visually inspect liners for wear. NOTE: Ring replacement and cylinder liner honing shculd be performed in accordance with TDI maintenance procedures.		X				Borescopic inspection is acceptible if heads are not removed. Complete TDI Inspection and Maintenance Record Form No. 315-1-1, TDI Instruction Manual, Volume I, Section 6. Use Volume I, Section 8, Appendix III for clearance values. Ref: Lead engine DR/QR Report #02-341B (Items 2, 3, 4)
		3. 135° fuel oil spray tips may be used if inspection results indicate a need for additional action to improve lubrication and reduce coke buildup.		X				Ref: 07/31/84 memo from L. Swanger to D. Pasquale

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		4. When replacing engine oil use H.D. oil that exceeds series 3 standards. The base stock should be more resistant to thermal degradation and coke formation. The additive package should provide high detergent dispersant properties with high alkalinity and a high level of antiwear additive such as zinc dithiophosphate. Total Base Number (TBN) should be 12 to 15 for use with #2 fuel oil and a sulfated ash content of 1.5% to 2.0% is preferred. An engine oil with such properties, Mobilguard 412 or equivalent product may be used to ensure improved lubrication.		X				NOTE: Do not mix L.O. brands or types. When changing L.O. replace the entire L.O. charge. Ref: 08/14/84 letter to C. Ray from M. Lowrey
02-341C	Piston Pin Assembly	1. Visually inspect all pins for chrome plate damage. Replace pins which show chipped or blistered chrome. NOTE: All new or replacement pins will be				X		Ref: Lead engine DR/QR Report #02-341C (Items 1&2), For details on acceptance criteria, Ref: 08/22/84 memo from W. Littmann to D. Pasquale NOTE: This inspection

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		L.P. or M.P. inspected before installation in Owners Group engines.						is to be performed whenever the engine is sufficantly dismantled to allow this inspection. Ref: Lead engine DR/QR Report #02-341C
		2. Inspect end plugs and reroll or replace any that are loose.				X		NOTE: This inspection is to be performed whenever the engine is sufficantly dismantled to allow this inspection.
02-345A	Intake and Exhaust Tappet Assembly	1. Inspect intake and exhaust tappet assembly condition.		X				Complete TDI Inspection and Maintenance Report Form No. 345-1-1, TDI Instruction Manual, Volume I, Section 6. Ref: Lead engine DR/QR Report #02-345A
		2. Verify that cam rollers are free to rotate, and that there is no measurable clearance between the cam rollers and the roller pins.		X				Complete TDI Inspection and Maintenance Record Form No. 345-1-1 TDI Instruction Manual, Vol. I, Section 6. Ref: Lead engine DR/QR Report #02-345A
02-345B	Fuel Tappet Assembly	1. Inspect fuel tappet assembly condition.		X				Complete TDI Inspection and Maintenance Report Form No. 345-1-1, TDI Instruction Manual, Volume I, Section 6. Ref: Lead engine DR/QR Report #02-345B

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		2. Verify that cam rollers are free to rotate, and that there is no measurable clearance between the cam rollers and the roller pins.		X				Complete TDI Inspection and Maintenance Record Form No. 345-1-1 TDI Instruction Manual, Vol. I, Section 6. Ref: Lead engine DR/QR Report #02-345B
02-350A	Cam Shaft Assembly	1. Perform a visual inspection of all cam lobe surfaces for signs of cracking, pitting or spalling.		X				Any signs of cracking, pitting or spalling shall be followed by a detailed analysis to evaluate the expected life based on the size and extent of surface distress and any corrective measures shall be implemented as indicated by this analysis. Signs of spalling shall result in immediate replacement of the cam. Ref: Lead engine DR/QR Report #02-350A
02-350B	Cam Shaft Bearings	1. Inspect and measure cam shaft bearing shells.				X		Complete TDI Inspection and Maintenance Record Form No. 350-1-1, TDI Instruction Manual, Volume I, Section 6. Use Volume I, Section 8, Appendix III for clearance values.

WNP-1 MAINTENANCE MATRIX

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-350C	Cam Gear	1. Visually inspect cam gear for chipped or broken teeth, pitting, excessive wear, or other abnormal conditions.		X				Ref: Memo from B. Bickford to E. Montgomery dated 6/23/84, Ref: Lead engine DR/QR Report #02-350C
		2. Measure gear back lash. NOTE - if cam gear hub is removed, it is ESSENTIAL that the nut be relocked at the position corresponding to the prescribed torque range of 70±10 ft-lbs. Insertion of the cotter pin must be accomplished at a torque $\geq$ 50 ft-lbs force and $\leq$ 90 ft-lbs force. If this is not possible another bolt, nut or washer should be used.			X			Complete applicable sections of TDI Inspection and Maintenance Record, Form No. 355-1-1, TDI Instruction Manual, Volume I, Section 8, Appendix III-1 for clearnance values. Ref: Lead engine DR/QR Report #02-350C
02-355A	Crank to Pump Gear	1. Visually inspect crankshaft to lube oil pump gear for chipped or broken teeth, excessive wear, or progressive pitting or other abnormal conditions.		X				Any abnormal situations or indications of progressive pitting should be reported for an engineering evaluation. Ref: Perry DR/QR Report #02-355A Task Description.

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		2. Measure gear backlash.			X			Complete applicable sections of TDI Inspection and Maintenance Record Form No. 355-1-1 TDI Manual, Volume I, Section 6. Use Volume 1, Section 8, Appendix III-1 clearance values. Ref: TDI Instruction Manual, Vol. I, Maintenance Schedule
02-355B	Idler Gear Assembly	1. Visually inspect idler gears for chipped or broken teeth, excessive wear pitting, or other abnormal conditions.		X				Any abnormal indications should be reported for an engineering evaluation. Ref: Lead engine DR/QR Report #02-355B
		2. Measure gear backlash NOTE: If idler gear hub is removed, it is recommended that the nut be relocked at the position corresponding to the torque of 80 ±20 ft-lbs. Insertion of the cotter pin must be accomplished at a torque ≥ 60 ft-lb and 100 ft-lbs. If this is not possible, another bolts, nut, or washer should be used.			X			Complete applicable sections of TDI Inspection and Maintenance Record Form No. 355-1-1, TDI Manual, Volume I, Section 6. Use Volume I, Section 8, Appendix III-1 for values. Ref: TDI Instruction Manual, Vol. I, Maintenance Schedule, Ref: Perry DR/QR Report #02-355B Task Description

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		3. The mating surfaces between the idler gear and hub should be throughly cleaned with solvent prior to assembly to ensure that there is an adequate friction coefficient between the parts.						Ref: Perry DR/QR Report #02-355B Task Description.
02-359	Air Start Valves	1. Remove, clean and inspect air start valves. (Replace copper valve-to-head gasket)		X				Ensure valve installation includes retorque requirements. Ref: DR/QR Report #02-359 (Items 1, 2, 3)
		2. Inspect the piston, cap, guide and housing sliding surfaces to evaluate wear or corrosion.		X				
		3. Ensure that the dryer between the air compressor after cooler and the air receivers is working properly by blowing down the air receivers daily and monitoring the moisture content.						To be performed daily. Ref: DR/QR Report #02-359

WNP-1 MAINTENANCE MATRIX

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-360A	Cylinder Head	1. Visually inspect cylinder heads (all cylinders).				X		Complete TDI Inspection and Maintenance Record Form No. 360-1-1, TDI Instruction Manual, Volume I, Section 6. One sheet for each head.
		2. Record cold compression pressures and maximum firing pressures.		X				If so indicated remove cylinder heads, grind valves and reseat. Ref: TDI Instruction Manual, Volume I, Section 6
		3. Blow-over the engine per TDI maintenance requirements, Volume I or at appropriate intervals after shutdown of the engine to ensure against harmful effects of water leaks.						In the event water is detected, the cylinder head should be replaced or returned to the vendor for repair. Ref: Lead engine DR/QR Report #02-360A
		4. Visually inspect the fuel injection port on each cylinder head "during" the normal monthly engine run for water leaks.	X					If water leakage is detected, the head(s) should be replaced. Ref: Lead engine DR/QR Report #02-360A

WNP-1 MAINTENANCE MATRIX

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-360B	Cylinder Head - Intake and Exhaust Valves	1. Visually inspect intake and exhaust valve, discs, stems and seats for wire drawing, pitting, distortion, concentricity, or any abnormal condition.				X		Complete the applicable sections of TDI Inspection and Maintenance Record Form 360-2-1.
		2. Visually inspect subcovers for evidence of valve guide blowby (Soot)						This is a one time only inspection to be performed after 500-600 hrs. of engine operation on new or reworked cylinder heads. Ref: Lead engine DR/QR Report #02-360B
		3. Measure intake and exhaust valves head thickness.				X		Complete applicable sections of TDI Inspection and Maintenance Records Form 360-2-1, TDI Instruction Manual, Volume I, Section 6. One sheet for each cylinder. Use Section 8, Appendix III for clearance values. (Items 3,4)
		4. Measure intake and exhaust valves - valve-to-guide clearances.				X		Complete applicable sections of TDI Inspection and Maintenance Record Form 360-2-1, TDI Instruction Manual, Volume I, Section 5. One sheet for each

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
								cylinder. Use Section 8, Appendix III for clearance values.
02-362A	Cylinder Head Covers - Subcover Assembly	1. Perform a liquid penetrant examination of the rocker arm pedestals top and vertical machined surfaces (connector pushrod side only) for signs of cracking at the counter bores.				X		This inspection is to be performed in conjunction with the rocker arm bushing inspections when the rocker arm shafts are removed from the subcovers (Ref: Lead engine DR/QR Report #02-390E) or when the rocker arm shaft assembly is removed. Subcovers with pedestal cracks that extend through the counter bore web down to the threads should be replaced. Ref: Lead engine DR/QR Report #02-362A
02-365A	Fuel Injection Pumps	1. Visually check pressure bleed screws for erosion.		X				To be performed on all sixteen pumps.
		2. Tear down one pump for inspection.			X			Use representative pump to determine need to overhaul other pumps. Ref: TDI Instruction Manual, Volume I, Maintenance Schedule

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		3. Complete fuel injection pump inspection in accordance with TDI Instruction and Maintenance Manual, Volume I.			X			Based on inspection results and operating parameters. NOTE - Disassembly of fuel injection pumps should be performed by a Bendix Corp. representative. Complete TDI Instruction and Maintenance Record Form No. 365-1-1, Section 6 (Items 1, 2). Ref: TDI Instruction Manual, Volume I, Maintenance Schedule for Item 3, Ref: Lead engine DR/QR Report #02-365A (Items 2&3)
02-365B	Fuel Injection Nozzles	1. Remove, inspect and clean tips.		X				Ensure that a new copper gasket is used upon reinstallation of nozzle into head. Complete TDI Inspection and Maintenance Record Form 365-2-1 Instruction Manual, Volume I, Section 6. Ref: TDI Instruction Manual, Vol. I Section 5 Maintenance Schedule, Ref: Lead engine DR/QR Report #02-365B (Items 1-4)

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		2. Check nozzle pop pressure.		X				
		3. Check spray pattern.		X				
		4. Check assembly for leakage.	X					To be performed with the engine running during the monthly test run.
02-365C	Fuel Injection Tubing	1. Check tubing for leaks at compression fittings.	X					All fuel oil leak inspections to be performed while the engine is running or whenever the compression fittings have been disturbed. Ref: Lead engine DR/QR Report #02-365C
		2. Visually inspect tubing lengths for F.O. leaks or cracks.	X					Fitting inspection for leaks to be performed at first engine operation following the installation of tubing. Subsequent inspections to be performed periodically as indicated. Fuel oil leakage from shrouded fuel oil lines can be detected at the leakoff ports in the base nuts, which are provided for this purpose. Ref: Letter from C.A. Malourh to V.A. Saleta dated 08/30/84.

WNP-1 MAINTENANCE MATRIX

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-365D	Fuel Oil Injection Lines: Supports	1. Visually inspect support elastomer inserts for deterioration or degredation.		X				Any inserts found to be unsatisfactory shall be replaced with new inserts prior to reassembly of F.O. lines. This inspection can be performed prior to reassembly of the F.O. lines in conjunction with the cylinder liner inspection. Ref: Lead engine DR/QR Report #02-315C Cylinder Liners, Ref: San Onofre DR/QR Report #02-365D Task Description.
02-371A	Fuel Pump Control Shaft	1. Check lube oil cups and fill as necessary.	X					Ref: Lead engine DR/QR Report #02-371A
02-371B	Fuel Pump Linkage Assembly and Bearings	1. Grease swivel link on F.O. pump assemblies, all cylinders.		X				
02-375	Intake Manifold	1. Care should be exercised in assembly of cylinder heads onto the engine, to avoid cracking of the intake manifold elbows.						If required, other castings may be tried to achieve an acceptable fit, or bolt hole diameters may be increased to 1/8" oversize. Component should under no circumstances be jacked to fit. Ref: Lead engine DR/QR Report #02-375

WNP-1 MAINTENANCE MATRIX

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-380A	Exhaust Manifold	1. Visually and MT examine a sampling of circumferential pipe welds and corresponding heat affected zones. This examination is to be performed in accordance with Impell memo from G. Shears to J. Kammeyer dated 08/13/84.			X			To be performed during the first refueling outage and alternate outages thereafter. However, diesel operation should not exceed 200 hours between inspections. Ref: Lead engine DR/QR Report #02-380A
02-385A	Crankcase Relief Valve	1. Clean flame arrestors.		X				Ref: 3/26/84 IOC from M. Wehmeyer to J. Kammeyer
		2. Inspect seat and disc.		X				
02-390E	Rocker Arm Bushings	1. Visually inspect and measure intake rocker arm bushings.						The visual and dimensional inspection of the rocker arm bushings should be conducted at the fuel outage which precedes 2300 hours of operation by at least the sum of expected hours of operation in a LOOP/LOCA event plus the expected hours of operation between outages. This inspection schedule may be revised after the first or subsequent inspections if the inspection results

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
								justify a longer period of engine operation between inspections. Ref: Lead engine DR/QR Report #02-390E (Items 1, 2, 3)
		2. Visually inspect and measure exhaust rocker arm bushings.						Not to exceed 1300 maximum hours of engine operation between inspections as described above.
		3. Visually inspect and measure intermediate rocker arm bushings.						Not to exceed 730 maximum hours of engine operation between inspection as described above.
02-390F	Hydraulic Valve Lifters	1. Check valve lash.		X				
		2. Reinstall and adjust lifters - perform leak down test.		X				Ensure lifters are installed with the fill holes up. Verify condition of lifters via comparison of lifter leak down rate (actual) to specifications noted on TDI Maintenance Manual Ref: TDI Maintenance Manual Section 6-B-5, Ref: 04/16/84 letter to R. Johnson from R. Jaquinto

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-390G	Rocker Arm Capscrews, Drive Studs (Pop Rivets)	1. Verify capscrew torque values.		X				This inspection should be performed at each outage if the rocker arms are disassembled for inspection. Use TDI Instruction Manual, Volume I, Section 8, Appendix IV for proper torque values.
		2. Verify that rocker arm drive studs are intact and tight.		X				Ref: Lead engine DR/QR Report #02-390G (Items 1, 2)
02-410A	Overspeed Trip Governor	1. Check trip set point - adjust as required.		X				Modify the surveillance testing procedure to include verification that the overspeed trip is correctly set to an overspeed trip setting of 518 rpm ±1 % every outage. Ensure that the electric governor and the mechanical backup governor setting are properly returned to their normal settings following the overspeed test. The test is to be performed with no load on the engine by increasing the normal governor speed setting(s) until a trip occurs. After several inspection periods, the history of the required adjustments

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
								should be reviewed to evaluate and possibly modify the testing interval. Ref: Lead engine DR/QR Report #02-410A
		Note: After setting the overspeed governor, the adjustment screw settings should be marked with Torque Seal to reveal any unintended changes in the set positions.						
02-410B	Overspeed Trip Governor and Accessory Drive	1. Remove plugs from housing and check for magnetic particles.		X				Ref: IOC dated 03/27/84 from M. Weymeyer to N. Cooperrider. (Items 1, 2, 3)
		2. Check shafts for excessive radial and axial movement.		X				
		3. Visually inspect accessory drive gear for excessive wear.		X				
02-410C	Overspeed Trip Drive Couplings	1. Remove the present L-110 Lovejoy couplings and replace them with new units in accordance with SIM 363 and DR/QR Report recommendations.						To be completed at the first refueling outage.

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		2. Verify that coupling is tight on shaft.		X				Ref: 6/24/84 memo from D. Limbert to E. Montgomery
		3. Replace the Lovejoy coupling spiders or test coupling elastomer for hardness.		X				Replace elastomer if nardness is greater than 90 Shore A. Ref: Lead engine DR/QR Report #02-410C (Items 1,2,3)
02-410D	Overspeed Trip Vent Valve	1. Disassemble and replace "O" rings.				X		Ref: Lead engine DR/QR Report #02-410D
02-411A	Governor Drive - Governor and Tachometer Drive (and driven) Gears and Shaft	1. Visually inspect drive (and driven) gears and shaft for signs of wear.		X				Ref: TDI Instruction Manual, Volume I, Section 5, Maintenance Schedule
02-411B	Governor Drive - Couplings, Pins and Keys	1. Check that coupling is tight on shaft.		X				If the coupling is found to be loose, it should be removed, all mating surfaces cleaned, and the unit reassembled using Loctite 609 on the mating surfaces. Ref: Lead engine DR/QR Report #02-411B (Items 1, 2, 3)
		2. Replace present neoprene insert in the Koppers coupling.						To performed prior to placing the engine in the emergency standby mode.

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		3. Replace elastomeric insert each refueling outage.		X				
02-413A	Governor Linkage	1. Inspection for loose parts should be performed.	X					Ref: DR/QR Report #02-413A
		2. Install positive locking hardware to the lever arm clamp bolt heads and shaft roll pins. NOTE: To be performed as necessary after tightening governor linkage hardware to design torque specifications.						
		3. Inspect for loose parts on the linkage assembly.	X					
		4. Lubricate cross shaft bearings cups.	X					Ref: Lead engine DR/QR Report #02-413A (Items 3&4)
		5. Grease the rod end fittings, especially those at the ends of the cross shaft.		X				
02-413B	Fuel Pump Linkage: Automatic Shutdown Cylinder	1. Check cylinder for extension and return.		X				To be accomplished during control system check.

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		2. Check tailrod vent for air leakage.		X				To be accomplished during control system check. Items 1, 2; Ref: IOC dated 3/26/84 from M. Wehmeyer to R. Kaklec
02-415A	Woodward Governor	1. Drain, flush, refill and vent actuator oil system with new oil from a clean container ensuring the appropriate cleanliness procedures are followed.			X			NOTE: Venting the hydraulic actuator shall be performed per the Woodward manual if more than a half quart of oil is added. Ref: Lead engine DR/QR Report #02-415A
		2. Disassemble, clean and refurbish the actuator.				X		Items 1, 2, 3; Ref: 03/27/84 IOC from M. Wehmeyer to N. Cooperrider Ref: TDI Instruction Manual, Volume I, Section 5 Maintenance Schedule
		3. Replace flex element for governor drive coupling.		X				Ref: Lead engine DR/QR Report #02-411B Governor Drive Couplings
		4. Verify all governor control knob settings are in appropriate positions: LOAD - Maximum DROOP - Zero Speed - To provide mechanical governor control at 460 rpm.	X					All knob settings should be secured with a commercially available product such as Torque-Seal.

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		5. Modify the surveillance testing procedures to include an evaluation of the governor settings be means of the two test below: (a) Perfrom a test of the governor settings while under mechanical /electrical governor control, with the diesel generator off the grid in the isochronous mode. (b) Perform a test of the governor settings while under mechanical (only) governor control, with the diesel generator off the grid in the isochronous mode.		X				NOTE: These tests shall include examinations of the engine speed transients during start and transient loading conditions. Included as part of the above tests is the verification that the engine set speed of 450 rpm is not exceeded by more than 7.5 percent (484 rpm max.) either during an engine start or during the largest single load reduction. Ref: Lead engine DR/QR Report #02-415A
		6. Augment the setting adjustment procedures as described in the Woodward manuals, to include a test of the governor response,						Ref: Lead engine DR/QR Report #02-415A

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		during an engine start to ensure agreement with the specification as detailed in Item #5 above.						
02-415B	Governor Booster Servomotor	1. Clean, inspect, and replace "O" rings and gaskets.				X		Ref: 3/27/84 IOC from M. Wehmeyer to J. Kammeyer
02-415C	Governor Heat Exchanger	1. Clean and inspect.				X		
02-425A	Jacket Water Pump - Gear	1. Visually inspect jacket water pump gear for chipped or broken teeth, excessive wear, or potential/progressive pitting or other abnormal conditions.		X				Any abnormal situations or indications of progressive pitting should be reported for an engineering evaluation. Ref: Lead engine DR/QR Report #02-355B
		2. Check the key to keyway interface for a tight fit on both the pump shaft to impeller and the spline to pump shaft during pump reassembly.		X				This along with the drive fit of the impeller on to the shaft will preclude past problems where relative motion between both shaft and impeller, and the spline and pump shaft caused fretting and upset of the keyway sides. Ref: DR/QR Report #02-425A
1		3. It is recommended that the castle nut that drives the external spline on its						Ref: DR/QR Report #02-425A To be performed upon reassembly.

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		taper, have minimum and maximum torque values of 120 ft-lbs and 660 ft-lbs respectively.						
02-435A	Jacket Water Fittings - Pipe and Fittings (Small Bore Scope Only)	1. Visually inspect for leaks. Note: In the event of a leak developing in the the existing Dresser Style 65 couplings, these couplings should be replaced with Dresser Style 90 couplings equipped with Viton gaskets.	X					This recommendation is made on the basis that the maximum suggested operating temperature of 150°F for the Style 65 coupling may be exceeded. The maximum suggested operating temperature of the Style 90 is 212°F. Ref: Letter dated 12/13/84 from C L Ray to J George. Ref: DR/QR Report #02-317A&B.
02-437	Turbo Water Piping - Pipe and Fittings	1. Visually inspect for leaks. Note: In the event of a leak developing in the the existing Dresser Style 65 couplings, these couplings should be replaced with Dresser Style 90 couplings equipped with Viton gaskets.	X					This recommendation is made on the basis that the maximum suggested operating temperature of 150°F for the Style 65 coupling may be exceeded. The maximum suggested operating temperature of the Style 90 is 212°F. Ref: Letter dated 12/13/84 from C L Ray to J George. Ref: DR/QR Report #02-317A&B.

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-441A	Starting Air Manifold: Air Vent	1. Ensure that the starting air manifold vent is open and effective.	X					Ref: 08/27/84 Memo from W. Littmann to J. Cadogan, Ref: Lead engine DR/QR Report #02-442A (STAD)
02-441B	Air Filter to Starting Air Distributor	1. Inspect filter elements.	X					Ref: TDI Instruction Manual, Vol. I, Maintenance Schedule
		2. Replace filter elements.		X				It is recommended that the filter be changed whenever the manufacturers recommended maximum differential pressure is achieved. Ref: Lead engine DR/QR Report #02-441B (Items 1&2)
	Strainer - Starting Air System	3. Blow down strainer DAILY.						Ref: Lead engine DR/QR Report #02-441B (Items 3&4)
		4. Clean and inspect strainer monthly.	X					If the strainer is excessively dirty, the frequency of cleaning and inspecting should be increased.

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
	Air Start Block Valves	5. Clean, refurbish valves -replace "O" rings and clean the screened fitting. Ensure leak tightness after reassembly.		X				Ref: Lead engine DR/QR Report #02-441B (Items 5, 6, 7)
		6. Inspect for tightness of fittings and bolts and apply locking compound, as required during reassembly of components.		X				
		7. Replace "O" rings of the shuttle valve.		X				
	Starting Air Valves	8. Disassemble clean, inspect and lubricate valves to prevent fouling. Test to assure leak tightness upon reassembly.		X				Ref: Lead engine DR/QR Report #02-441B.
02-455A	Fuel Oil Filter	1. Record filter d/p.	X					Change filter elements at or before the filter d/p reaches the manufacturers recommended maximum differential pressure. Purge entrapped air from the filter canister using the vent valve provided, and divert some fuel oil into the newly

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
								replaced cartridge. After air has been purged close vent valve and return handle to previous operating position. Ref: Lead engine DR/QR Report #02-455A
		2. Inspect canister gaskets and replace as necessary.		X				To be performed during change out of filter elements. Ref: 3/27/84 IOC from M. Wehmeyer to J. DiMare,
		3. Inspect tubing and mechanical connections for tightness and/or leaks.	X					Ref: TDI Instruction Manual, Volume I
02-455B	Fuel Oil Strainers	1. Record strainer d/p.	X					Shift/clean element if manufacturers recommended maximum differential pressure is achieved. Bolt torques of 120-150 in-lbs should be utilized during reassembly Ref: Lead engine DR/QR Report #02-455B (Items 1 & 2)
		2. Purge air from stand-by strainers						As required.

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-465A	Lube Oil Lines External: Tubing, Fitting and Couplings	1. Ensure that a minimum installation gap of 0.171 inches is maintained between pipe ends at the 12-inch Dresser coupling.						To be performed whenever piping is installed or reinstalled. Ref: DR/QR Report #02-465A
		2. Replace the 12-inch Dresser coupling gasket with a VITON gasket should leaks develop.						Ref: Shearon Harris DR/QR Report #02-465A Task Description.
02-467A	Turbocharger Lube Oil Fitting: Pipe, Tubing, Fittings and Flexible Coupling (Small Bore Scope Only)	1. Visually inspect for leaks. Note: In the event of a leak developing in the the existing Dresser Style 65 couplings, these couplings should be replaced with Dresser Style 90 couplings equipped with Viton gaskets.	X					This recommendation is made on the basis that the maximum suggested operating temperature of 150°F for the Style 65 coupling may be exceeded. The maximum suggested operating temperature of the Style 90 is 212°F. Ref: Letter dated 12/13/84 from C L Ray to J George. Ref: DR/QR Report #02-317A&B.
02-475A,C	Turbocharger: Bracket Bolting and Gaskets	1. Each month for the first three months of commercial operation these screws should be inspected to assure that no screw has loosended because of engine operating loads. If during these inspections none of the screws are found						Refr: DR/QR Reports #02-475A,C

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		loosened or damaged, from then on inspections are to be conducted on a yearly basis (or during plant shutdown). But if any time during inspection any screw is found loosened or damaged, it mus then be replaced (if damaged) and all screws retorqued as follows; 125 ft-lbs for bracket to engine screws and 75 ft-lbs for the bracket to turbo base screws. Note: To avoid damage to bracket to engine, and/or bracket to turbo, base screws, the proper torques as delinated above should be utilized for each respective bracket bolting application.						
02-475B	Air Butterfly Valve	1. Lube valve shaft via grease fittings.		X				Ref: IOC dated 3/28/84 from M. Wehmeyer to J. DiMare. If oil cups are used, this should be completed monthly.
		2. Check valve disc for freedom of movement.	X					Check by visually observing valve/actuator operation. Ref: 04/16/84 from R. Jaquinto to R. Johnson

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		3. Verify that associated locking devices (jam nuts and lock washers) are tight.	X					Ref: DR/QR Report #02-475B
02-500A	Engine Control Cabinet	1. Inspect interior of cabinet for cleanliness and clean as required.		X				Ref: 3/29/84 IOC from M. Wehmeyer to T. Jacobs for Items 1-5, Ref: 07/30/84 IOC from J. Cadogan to K. Horelik for Items 1-6
		2. Visually check wiring for insulation degradation.		X				
		3. Visually check instrument tubing for leaks.		X				
		4. Functionally check cabinet heater and calibration of thermostat.		X				
		5. Test pneumatic S/D board logic.		X				
		6. Replace "O" rings, gaskets and filter in pressure regulator.		X				
02-500C	Circuit Breakers and Contact Blocks	1. Check all terminals clean/tighten.		X				To be accomplished during panel clean/inspection.

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		2. Visually check wiring insulation for degradation.		X				To be accomplished during panel clean/inspection.
		3. Trip check circuit breakers.		X				
02-500G	Control Panel Valves	1. Inspect and clean control panel valves.		X				This recommendation interval should be reassessed depending on the degree of system fouling. Ref: Lead engine DR/QR Report #02-500G
		2. Inspect and clean the 200 mesh screen in the check valve.		X				Ref: Lead engine DR/QR Report #02-500G
02-500J	Control Panel Assembly: Relays	1. Inspect contacts and clean as required.		X				Ref: 08/10/84 IOC from K. Horelik to J. Cadogan
		2. Visually check condition of wiring and tightness of terminations.		X				
02-500N	Control Panel Switches Terminal Boards and Wiring	1. Clean terminal boards and switch contacts.		X				Ref: IOC dated 3/29/84 to J. Kammeyer from M. Wehmeyer for Items 1, 2, 3.
		2. Visually check wire insulation and terminals for tightness and degradation.		X				
		3. Inspect for arcing and overheating.		X				

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02-525B	Barring Device Control Valve	1. Drain filter daily while barring device is in operation.						Ref: Lead engine DR/QR #02-525B (Items 1, 2)
		2. Replace regulator elastometric parts.				X		
02-550	Foundation Bolts	1. Visually inspect foundation for breaks in the bond between the sole plates and grout.		X				Ref: TDI Instruction Manual, Maintenance Schedule, Section 5
		2. Check foundation bolts for correct torque. Retorque as necessary then recheck crankshaft web deflections.		X				Use TDI Instruction Manual, Volume I, Section 8, Appendix IV for proper torque values.
		3. Generator foundation bolts are to be retorqued after a generator short circuit if the bolts were initially torqued to 480 ft-lbs. If initial bolt torque was 600 ft-lb no retorque is required.						Ref: Lead engine DR/QR Report #02-550
02-630D	Thermocouples	1. Check that thermocouple indicates ambient engine temperature when the engine is cold.		X				An inconsistant reading traced to thermocouple trouble should result in replacement of the thermocouple.

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		2. Clean and inspect thermocouples and thermocouple shields.			X			Indications of fatigue should result in replacement of the thermocouple and/or thermocouple shield. Ref: 7/31/84 Memo from S. Riess to W. Littmann
		3. Pyrometer wiring-check that terminations are tight.						To be accomplished during control panel check-out and initial operation inspection. Items 1, 2, 3; Ref: 07-30-84 IOC from J. Cadogan to S. Riess
02-695B	Engine Control Air Pressure Regulator	1. Inspect and clean engine shutdown equipment.		X				NOTE: This recommendation should be assessed depending on the degree of system fouling Ref: Lead engine DR/QR Report #02-695B (Items 1 & 2)
		2. Replace elastomeric parts and gaskets in the pressure regulator.		X				
02-695C	Engine Control Pneumatic Trip Switches	1. Check switch set points.		X				Pressure switches. Ref: 3/30/84 IOC from M. Wehmeyer to J. DiMare
		2. Replace elastomeric parts.				X		

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-700E	Jacket Water Standpipe and Miscellaneuous Bolting	1. Visually inspect jacket water standpipe, pump suction and engine return nozzle welds during each routine engine run and every 100 hours during extended engine runs.						Any visible cracking or minor jacket water leakage should result in rework of nozzle welds. Ref: DR/QR Report #02-700F
02-717B	Auxiliary Sub-base & Oil & Water Piping - Jacket Water. Valves	1. Inspect the valves for packing leakage.	X					Replace as necessary. Ref: Lead engine DR/QR Report #02-717B
02-717C	Auxiliary Sub-Base & Oil & Water Piping-Jacket Water: Pipe, Couplings, Fittings, Orifices, Y-Strainers (Small Bore Scope Only)	1. Visually inspect for leaks. Note: In the event of a leak developing in the the existing Dresser Style 65 couplings, these couplings should be replaced with Dresser Style 90 couplings equipped with Viton gaskets.	X					This recommendation is made on the basis that the maximum suggested operating temperature of 150°F for the Style 65 coupling may be exceeded. The maximum suggested operating temperature of the Style 90 is 212°F. Ref: Letter dated 12/13/84 from C L Ray to J George.
02-717F	Auxiliary Sub-Base Lube Oil Pipe and Fittings	1. Visually inspect pipes and joints for leaks. Note: In the event of a leak developing in the existing Dresser Style 65 couplings, these couplings should be replaced with Dresser Style 90 couplings	X					This recommendation is made on the basis that the maximum suggested operating temperature of 150°F for the Style 65 coupling may be exceeded. The maximum suggested operating temperature of the Style 90 is 212°F.

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Component Number	Component Identification		PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
			equipped with Viton gaskets.						Ref: Letter dated 12/13/84 from C L Ray to J George. Ref: Ref: 04/02/84 IOC from M. Wehmeyer to J. Freeman
		2.	Clean and inspect L.O. keep-warm pump suction strainer.		X				Complete when L.O. tank is drained. Ref: 04/16/84 letter from R. Jaquinto to R. Johnson
02-717G	Auxiliary Sub-Base Lube Oil Valves	1.	Disassemble, lubricate, inspect and refurbish.		X				Ref: IOC dated 4/6/84 from M. Wehmeyer to J. DiMare. Ref: Lead engine DR/QR Report #02-717G
		2.	Dissassemble, clean and check relief valve lift pressure.				X		Ref: 07/31/84 IOC to M. McGerigle from J. Cadogan, Ref: 08/16/84 IOC from M. McGerigle to J. Cadogan, Ref: Lead engine DR/QR Report #02-717G (Items 1 & 2)
02-717K	Auxiliary Sub-Base and Oil and Water Piping: Fuel Oil Valves	1.	Dissassemble, lubricate, inspect and refurbish.		X				Ref: IOC dated 04/06/84 from M. Wehmeyer to J. DiMare. Ref: Lead engine DR/QR Report #02-717K

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-717N	Jacket Water Heat Exchanger	1. To avoid corrosion and fouling the jacket water heat exchanger and associated service water piping should be flushed on a periodic basis (continuous service flow is sufficient). Alternatively, service water chemistry control can be used to maintain heat exchanger performance and integrity.						Ref: Lead engine DR/QR Report #02-810C, Ref: 04/20/84 IOC from M. Wehmeyer to R. Kadlec, Note: it would be at the discretion of WNP-1 to determine the frequency of this inspection.
		2. Perform a daily visual inspection for leakage at packing whenever the engine is in the emergency standby mode. Verify that no leakage is present through the leak-off ports of the lantern ring.						To be performed daily. Ref: 07/19/84 Telecon D. Pasquale and R. Chii
		3. Record heat exchanger performance by checking engine operating parameters.	X					Use for trend data
		4. Evaluate heat exchanger performance data.		X				

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		5. Inspect tubes and tube sheet for fouling and errosion - remove entrance and exit channel covers.		X				Ref: TDI Instruction Manual, Volume I, Maintenance Schedule
		6. Inspect and clean lantern ring. Verify leak-off holes are not plugged.		X				Replace/rework lantern ring as necessary to ensure concentricity prior to reinstallation.
		7. Replace packing rings.		X				Replace packing when packing becomes hard or leakage at the packing is noted and cannot be stopped by tightening. Ref: Lead engine DR/QR Report #02-810C
02-7170	Lube Oil Heat Exchanger	1. Perform a daily visual inspection for leakage at packing. Verify that no leakage is present through the leak-off ports of the lantern ring.						Ref: Shoreham DR/QR Report #10-104, Ref: 06/12/84 IOC from R. Chii to P. Martia, Ref: 04/02/84 IOC from H. Wehmeyer to R. Kadlec

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		2. Record heat exchanger performance by checking engine operating parameters.	X					Use for trend data
		3. Evaluate heat exchanger performance data.		X				
		4. Inspect tubes and tube sheet for erosion and fouling - remove entrance and exit channel covers.		X				Ref: TDI Instruction Manual, Volume I, Maintenance Schedule, Ref: 07/19/84 Telecon D. Pasquale and R. Chii
		5. Inspect and clean lantern ring. Verify leak-off holes are not plugged.		X				Replace/rework lantern ring as necessary to ensure concentricity.
		6. Replace packing rings at the floating tube sheet during reassembly after each inspection.		X				And/or packing becomes hard or leakage at the packing is noted and cannot be stopped by tightening.
		7. Perform a spectro chemical analysis of the lube oil.						To be performed at approximate quarterly intervals.
		Particular attention shall be given to percent moisture content.						Ref: Lead engine DR/QR Report #02-820G

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02-717R	Lube Oil Keep-Warm Pump	1. Check operation of pump/motor bearings.	X					Items 1-5; Ref: 04/05/84 IOC from M. Wehmeyer to T. Fritsch
		2. Check mechanical seal leakage.	X					
		3. Measure unit vibration (pump/motor)		X				
1		4. The pump should be inspected for signs of leakage and corrective modifications (addition of flexible piping connections) be implemented as required.						To be performed daily Refr: DR/QR Report #02-820
02-717S	Lube Oil Keep-Warm Filter	1. Record filter d/p.	X					Ref: 04/05/84 IOC from M. Wehmeyer to J. DiMare
		2. Change filter elements.						To be performed before the filter d/p reaches the manufacturers recommended maximum differential pressure. Ref: Lead engine DR/QR Report #02-820E

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-717V	Prelube Oil Pump Strainer	1. Check strainer differential pressure DAILY.						Clean and/or replace the element when the manufacturer's recommended maximum differential pressure is achieved. Ref: Shearon Harris DR/QR Report #02-465D Task Description
02-810A	Thermostatic Valves	1. Replace thermal power elements at 3 to 5 year intervals.				X		Ref: Lead engine DR/QR Report #02-810D (Items 1, 2)
		2. Visually inspect valve body for evidence of leakage.	X					To be accomplished during monthly test run. Ensure that any replacement valves have cast steel valve bodies.
02-810B	Jacket Water Heaters	1. Measure heater insulation resistance.		X				Replace heater if degradation of insulation resistance is noted. Ref: 5/10/84 IOC from M. McGerigle to W. Brown for Items 1, 2, 3
		2. Clean and inspect heater elements.		X				
			X					
		3. Check calibration and inspect thermostat.						
02-820A	Lube Oil Sump Tank Heaters	1. Measure heater insulation resistance.		X				Replace heater if degradation of insulation resistance is noted.

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		2. Inspect and clean heater elements.		X				To be accomplished during tank inspection.
		3. Check calibration and inspect condition of thermostat.		X				Ref: 05/10/84 IOC from M. McGerigle to W. Brown for Items 1, 2, 3
02-835B	Diesel Starting Air Compressors	1. Check lubricating oil level.	X					All items; Ref: 04/02/84 IOC with attached Maintenance Chart from M. Wehmeyer to J. Kammeyer.
		2. Overall visual inspection.	X					
		3. Clean fins on inter and after coolers.		X				
		4. Replace intake filter element.		X				
		5. Change compressor oil.		X				
		6. Check belt tension.		X				
		7. Check pulley clamp bolts/set screws tight.		X				
		8. Inspect filter felts on unloader system.		X				Replace as necessary.

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-835F	Starting Air Tank	1. Drain air receiver float traps or drain valves DAILY and monitor the quantity of moisture produced at the float traps or drain valves.						If quantity of moisture is excessive correct immediately. Check air dryer operation. Ref: Lead engine DR/QR Report #02-835J
		2. Disassemble and clean the float trap.			X			Ref: IOC dated 05/08/84 from P. Titus to P. Martin (Items 1 & 2)
		3. Starting air tank pressure gauges - calibration check.		X				
		4. Starting air tank pressure switches - calibration check.		X				
02-835G	Air Dryers and Moisture Traps	1. Blow down trap sediment bowls.	X					Ref: 04/05/84 IOC from M. Wehmeyer to J. Kammeyer, Ref: TDI Instruction Manual, Volume I, Maintenance Schedule
		2. Inspect and service moisture traps.		X				
		3. Check proper operation of desiccant dryer.	X					Replace desiccant charge as required. Ref: 04/16/84 letter from R. Jaquinto to R. Johnson

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WNP-1 MAINTENANCE MATRIX

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
02-835J	Starting Air Float Trap	1. Verify operability daily						Ref: Rancho Seco DR/QR Report #03-835C Task Description (Items 1, 2)
		2. Disassemble, clean and inspect.		X				
84-101A	Emergency Generator	1. Check operation of brushes and slip rings.	X					Ref. IOC dated 03/30/84 M. Wehmeyer to D. Mercald (Items 1-5).
		2. Clean/inspect all accessible parts of the generator.		X				
		3. Megger rotor and stator.		X				
		4. Verify operation of space heaters.	X					
		5. Measure vibration and check against base line data.		X				
84-101B	Emergency Generator Pedestal Bearing	1. Check ring oilers for proper operation and verify oil level.	X					To be accomplished during every test run of the engine. Ref: 3/30/84 IOC from M. Wehmeyer to N. Cooperrider (Items 1-4)
		2. Drain flush refill bearing housing.		X				

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		3. Measure bearing housing insulation resistance.		X				
		4. Disassemble and inspect bearing and check clearances.				X		
84-111	Intake Air Filters	1. Inspect air intake filters every 3 to 6 months.						Replace if necessary. Ref: Lead engine DR/QR Report #02-805B
84-114	Flex Connection	1. Visually inspect for evidence of cuts, holes, or dents.			X			
84-115	Full Flow Lube Oil Filters	1. Record filter d/p.	X					Use for trend data, Ref: 04/02/84 IOC from M. Wehmeyer to J. DiMare, Ref: TDI Instruction Manual, Volume I, Maintenance Schedule
		2. Drain water and/or sludge from lubricating oil full flow filter.	X					
		3. Replace filter cartridges and perform a visual inspection to determine the nature of the						To be performed before the filter d/p reaches the manufacturers recommended maximum differential pressure. Ref: 05/30/84 IOC from M. McGerigle

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		material caught in the filter.						to B. Brown, Ref: Lead engine DR/QR Report #02-820F, Ref: 07/31/84 IOC from J. Cadogan to M. McGerigle
		4. Lube oil filter gauge - calibration check.		X				
84-121	Emergency Generator Control Panel	1. Inspect panel for cleanliness and clean as required.		X				Items 1-5; Ref: 3/30/84 IOC from M. Wehmeyer to D. Mercaldi
		2. Check terminal boards for loose wiring.		X				
		3. Visually check condition of wire insulation for degradation.		X				
		4. Clean and inspect relay contacts.		X				
		5. Check meter calibrations.		X				
		6. Bridge rectifier assembly. and SCR mounting.						Ref: DR/QR Report #02-650B, Attach. 1
		a. Inspect the temperature sensitive label placed on the most visible face of the hexagonal		X				If either of the labels permanently blacken the maximum temperature of the diode and/or SCR has been

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		body of the diodes and the SCR. These labels shall be inspected before and after each running of the engine.						exceeded requiring an electrical inspection and an inspection of the mounting threads of the heat sinks and diode and/or SCR. Replace the diode and/or SCR and the heat sinks as needed and assure that proper mounting tightness of 300 in-lbs (diode) and 275 in-lbs (SCR) and proper thread conditions are maintained.
		b. Inspect glyptol applied to the side of the lugs and mounting bolt for the lugs which attach to the bottom of the diode and the SCR heatsinks for signs of relative motion.	X					To be performed after each monthly test run. Retighten any loose connections, remove old glyptol and reapply if connections are retightened.
		7. Adjustment potenticmeters - inspect glyptol applied to the the side of the adjustment screws for each of the five adjustment potentiometers on the printed circuit board of the voltage regulator for signs of relative motion.	X					To be performed after each monthly test run. If adjustments are needed, remove glyptol and reapply when the adjustment procedure is complete.

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		8. Printed circuit boards - check for cleanliness and proper mounting of components.	X					To be performed after each monthly test run. Report any abnormal conditions to engineering for evaluation.
	Jacket Water System	1. Check pH. factor of jacket water and correct as recommended by chemical supplier.	X					Ref: TDI Instruction Manual, Volume I, Maintenance Schedule
		2. Replace elastomeric parts in jacket water valves.				X		
	Lube Oil System	1. Check lubricating oil with a viscosimeter for fuel oil dilution. Send a sample of oil to laboratory for analysis.	X					Ref: TDI Instruction Manual, Volume I, Maintenance Schedule, Items 1, 2
		2. Drain lubricating oil system and clean sump tank. Depending on the results of lube oil analysis, refill with new oil.		X				When replacing engine oil use H.D. oil that meets or exceeds series 3 standards. The base stock should be more resistant to thermal degradation and coke formation. The additive package should provide high detergent dispersant properties with high alkalinity and a high level of antiwear

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
								additive such as zinc dithiophosphate. Total Base Number (TBN) should be 12 to 15 for use with #2 fuel oil and a sulfated ash content of 1.5% to 2.0% is preferred. An engine oil with such properties, Mobilguard 412 or equivalent product may be used to insure improved lubrication.
		3. Visually inspect lube oil sump tank level switch floats. Check switch set points.		X				To be performed after lube oil has been drained from sump.
		4. Perform a spectro-chemical analysis of the lube oil.						To be performed at approximately quarterly intervals. Ref: TDI Instruction Manual, Volume I, Maintenance Schedule.
	System Operation	1. Record all operating parameters. Compare with base line data to ensure engine is operating properly.	X					To be performed during monthly engine test run.
	Piping System	1. Conduct a detailed visual and audible	X					Tighten, repair or replace as required.

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Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
		inspection of all fuel, air, oil, and water piping and valves for leakage.						Ref: TDI Instruction Manual, Volume I, Maintenance Schedule
		2. Inspect, clean and as applicable, lubricate manual valves on skid.		X				
	Engine Internals	1. Remove alternate left side doors and examine the inside of the engine for any abnormal conditions. Check with a good light for evidence of babbit flakes.		X				If excessive water, sludge or any indication of bearing failure is present, drain crankcase, determine cause, and take necessary action.
Miscell-anceous	Engine Mounted Pressure Switches	1. Replace elastomeric parts.				X		
	Gear Train	1. Inspect gears for general condition.		X				
		2. Measure gear back lash on all gears.			X			Replace worn gears exceeding maximum clearance. Complete TDI Inspection and Maintenance Form No. 355-1-1 TDI Instruction Manual, Vol. I, Section 5. Use

Component Number	Component Identification	PM Recommendation	Monthly	Outage	Alt. Outage	5 Year	10 Year	Comments
								Vol. I, Section 8 Appendix III-I for clearance values. Ref: 04/16/84 letter from R. Jaquinto to R. Johnston

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ENGINEERING REVIEW CRITERIA DOCUMENT

FOR

THE DESIGN REVIEW OF THE TDI DIESEL

SMALL BORE PIPING, TUBING AND SUPPORTS

FOR THE TDI OWNERS GROUP

Report No. 11600.60-DC-02
Revision 1

Prepared
by

Stone & Webster Engineering Corporation
Boston, Massachusetts

December 1984

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TDI OWNERS GROUP

ENGINEERING REVIEW CRITERIA DOCUMENT FOR THE DESIGN REVIEW OF THE TDI DIESEL SMALL BORE PIPING, TUBING AND SUPPORTS FOR THE TDI OWNERS GROUP

1.0 INTRODUCTION

The TDI Emergency Diesel Generator Owners Group Program requires Design and Quality Revalidation reviews to independently verify the structural adequacy of the small bore piping, tubing and associated supports to withstand the effects of normal operating and earthquake loadings. This report provides the criteria to be used to perform the review.

2.0 APPLICABILITY

The requirements of the review contained in this report are applicable to all TDI supplied small bore piping and tubing systems including associated supports contained in the diesel engine and its skid, unless specifically excluded by an approved Task Description in accordance with TDI Diesel Generator Owners Group Procedure DG-3.

3.0 OBJECTIVE

The objective of this report is to provide the criteria to be utilized to verify that the small bore piping, tubing and supports will perform their intended function under all normal and earthquake loadings.

4.0 REVIEW METHODS

4.1 Review of Existing TDI Documentation

The initial method to be utilized in determining a component's acceptability is to perform a review of all existing small bore pipe stress and support documentation provided by TDI.

The documentation will be reviewed to determine if it provides an adequate design basis in accordance with the appropriate codes as delineated by the individual utilities design specification for the diesel engine, The review shall also compare the as built piping and support condition to the existing design basis to determine compatability.

If, after completing the review, the engineer determines that the component is acceptable, based on the existing documentation, the Component Design Report will be issued stating the conclusion of acceptability.

If TDI documentation is not available, or if it is determined that the available documentation does not readily lead to a conclusion of accpetability the engineer will alternatively continue the review as outlined in the following paragraphs.

4.2 Review of Small Bore Piping for Acceptability

In cases where the review of TDI documentation does not lead to component acceptability, the engineer will judge if the component will perform its intended function under all normal and earthquake loadings. This judgment will be based on a review of the following information:

Quality approved as built piping isometrics

System operating parameters

Physical piping data

Site specific amplified response spectra

System function

In addition to reviewing the above information, a physical walkdown of the engine and skid piping may be required. The walkdown would include a review of the piping to determine pipe support type and function, as well as a review for the following:

Thermal flexibility: The engineer will determine if sufficient flexibility exists for each between support section of small bore piping. The thermal movement imparted by the supports onto the piping will also be considered.

Deadweight spans: The deadweight spans between supports will be reviewed by the engineer and acceptability will be based on judgment.

Seismic spans: The seismic spans between supports will be reviewed by the engineer and acceptability will be based on judgment. The engineer's judgment will consider the site specific amplified response spectra and all components, fittings and branch connections. Engine induced vibration will also be considered in determining acceptability of seismic spans and is further discussed in paragraph 4.5.

The engineer will document the reviews of the individual components by a written trip report. The trip report will serve as a summarization of the engineering walkdown.

In cases where the engineer judges that the component will perform its intended design function the Component Design Report will be issued stating the conclusion of acceptability.

In cases where the engineer judges that a modification may be required to assure functional capability, a recommendation for the modification will be stated in the conclusions of the Component Design Review. The analyst may perform calculations to support the judgment in cases where it is not apparent that a modification is required. The object of these calculations is not to provide code compliance, but specific codes may be referenced for guidance.

4.3 Review of Tubing for Acceptability

A field walkdown of all critical tubing components will be required. The same methods as outline in paragraph 4.2 for small bore piping review will be employed for tubing.

4.4 Review of Small Bore Piping and Tubing Support

In cases where the review of TDI documentation, as outlined in paragraph 4.1, does not lead to component acceptability the engineer must continue the review based on the following:

1) Quality approved as bu.lt support sketches, if available.

2) Physical support data

3) Anticipated support loads

In addition to, or in conjunction with, reviewing the above information, a physical walkdown of the engine and skid supports may be required. The walkdown would consist of a review of the following support components so that the engineer may judge if the support will perform its intended function:

1) Structural members

2) Structural bolts and base plates

3) Welds

The engineer will document the review and recommend modifications as outlined in paragraph 4.2.

4.5 Engine Induced Vibration

The effects of engine induced vibration will be considered in determing the adequacy of the piping spans for dynamic loading. Specifically, the engineer

will determine if the existing piping spans may cause the piping to respond at the resonant frequency of the engine. This determination may be based on calculation or review of the vibration test results obtained at Shoreham and Comanche Peak. Another acceptable method of considering engine induced vibration is to compare the specific engine small bore piping or tubing with proven acceptable design experience.

The documentation of acceptability or recommendation of modifications will be in accordance with paragraph 4.2.

5.0 SPECIAL COMPONENTS

5.1 Dresser Compression Coupling

Based on review of the small bore Dresser couplings at Shoreham, it is not required to perform qualifying calculations for the coupling on the remaining engines. The couplings are inherently qualified based on acceptability of the attached piping.

5.2 Pipe Flanges

Based on review of the small bore pipe flanges at Shoreham, it is not required to perform qualifying calculations for the flanges on the remaining engines. The flanges are inherently qualified based on acceptability of the attached piping.

DESIGN CRITERIA FOR
DIESEL GENERATOR
LARGE DIAMETER PIPING FOR WPPSS - NUCLEAR PROJECT 1

Submitted to
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Charlotte, North Carolina

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Report No. 02-0630-1305
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1.0 PURPOSE

The purpose of this document is to provide structural acceptance criteria for evaluation of the Transamerica Delaval, Inc. (TDI), large diameter, diesel generator skid mounted piping at the Washington Public Power Supply System (WPPSS) Nuclear Project 1. This criteria was based primarily upon the philosophy embodied in industry accepted Codes and Standards for design of nuclear power station piping.

2.0 APPLICABLE CODES

2.1 Diesel Generator Specification Requirements

The WPPSS Diesel Generator Specification, (Ref. 1), invokes ASME III - Class 3 (Ref. 2) for piping furnished external to the engine assembly (i.e., off-engine) and ANSI B31.1 (Ref. 3) for on-engine piping.

2.2 Code Requirements

2.2.1 Diesel Engine Manufacturers Association (DEMA) Standards

The DEMA Standard (Ref. 4) extensively covers the detailed performance requirements of systems and subsystems for diesel engine driven electric power generating units, but does not cover analytical requirements or allowable stresses for piping systems. It relies on other codes for these requirements but does not specifically reference any.

2.2.2 American Bureau of Ships Building Code

Section 36 of the American Bureau of Ships Building Code (Ref. 5) discusses requirements for pumps and piping systems. This code presents very few design requirements, providing specific analytical formulas only for pipe wall thickness versus piping design pressure. The code makes no specific provisions for analysis for deadweight, thermal expansion, or dynamic effects. Piping materials and allowable membrane stresses are addressed in this code. For example, ASTM A53 Grade B and A106 Grade B are approved materials. It is noted that this code provides tabulated membrane stress allowables which are the same as for B31.1 (Ref. 3) and ASME III Class 3 and 2 (Refs. 2 and 6).

2.2.3 ANSI B31.1 and B31.3

The general philosophy of ANSI B31.1 (Ref. 3) and B31.3 (Ref. 7) is to parallel those provisions of Section I "Power Boilers" of the ASME Boiler and Pressure Vessel Code, as they can be applied to piping systems functioning at elevated pressures and temperatures. These codes are conservative, reflecting the general need for long service life and maximum reliability in power, chemical, and petroleum refinery installations.

B31.1 and B31.3 are quite similar, except that B31.3 allowable stresses are somewhat more permissive than B31.1 values. Both are all inclusive codes which set forth engineering requirements for design and construction of piping systems. These codes contain basic reference data and formulas deemed necessary for design, including the following:

(1) Material specifications and component standards which have been accepted for code usage;

(2) The designation of proper dimensional standards for the elements comprising piping systems;

(3) Requirements for the design of component parts and assembled units, including necessary pipe supporting elements;

(4) Requirements for the evaluation and limitation of stresses, reactions, and movements associated with pressure, temperature, and external forces;

(5) Requirements for the fabrication, assembly, and erection of piping systems.

(6) Requirements for testing and inspection of elements before assembly or erection and of the completed systems after erection.

2.2.4 ANSI B31.7

ANSI B31.7 "Nuclear Power Piping" (Ref. 8) was the precursor of ASME III-Class 1 Subarticle NB-3600, which covers ASME Code Class 1 piping design, and embraces the same design philosophy as ASME III-Class 1 (Ref. 9).

2.2.5 ASME Code, Section III

The ASME Boiler and Pressure Vessel Code provides rules for the construction of boilers, pressure vessels, and nuclear components. Section III of this Code addresses nuclear power plant components, and consists of two (2) divisions. Division 2 covers concrete reactor vessels and containments and is not pertinent here. Division 1 consists of the following subsections:

NCA	General Requirements
NB	Class 1 Components
NC	Class 2 Components
ND	Class 3 Components
NE	Class MC Components
NF	Components Supports
NG	Core Support Structures
Appendices	

Each subsection is divided into articles as follows:

Article 1000	Introduction and Scope
Article 2000	Material
Article 3000	Design
Article 4000	Fabrication and Installation
Article 5000	Examination
Article 6000	Testing
Article 7000	Overpressure Protection
Article 8000	Nameplates, Stamping and Reports

The code recognizes that various components have different levels of importance associated with the components' function, as related to the safe operation of the nuclear power plant. The code classes thus permit a choice of rules that provide assurance of structural integrity and quality commensurate with the relative importance assigned to the individual items. Class 1 components are assigned the highest level of importance. Reactor coolant pressure boundary components are examples of what is normally assigned as ASME III-Class 1. Class 2 components are assigned the next lower level of importance. Nuclear safety related components other than reactor coolant pressure boundary components are examples of what is normally assigned to ASME III-Class 2. Class 3 components are usually of the same level of importance as Class 2 components, but are assigned to ASME III-Class 3 by virtue of their moderate normal operating temperatures and pressures.

ASME Code Section III does not provide guidance in the selection of component classification and places the responsibility of such component classification on the owner of the nuclear power plant.

2.3 Applicable Code Acceptance Criteria

Those portions of the applicable building codes and standards which refer to structural integrity of the subject piping are addressed herein. The portions of these codes which provide requirements for documentation and other quality assurance related requirements, as well as adequacy of system design requirements such as overpressure protection adequacy, are not part of this scope.

The WPPSS Diesel Generator Specification, Ref. 1, invokes ASME III - Class 3 (1974 edition, including addenda through Winter 1974) for off-engine piping and ANSI B31.1 (1973 edition, including summer and winter addenda) for on-engine piping. This classification is consistent with the moderate service temperatures and pressures associated with the subject piping. ASME III - Class 3 applies specifically to nuclear safety related piping, having rigorous analytical requirements that are acceptable to the nuclear industry and the U.S. Nuclear Regulatory Commission. ANSI B31.1 and ANSI B31.3, by virtue of their similarity to ASME III - Class 3, are also applicable.

Since ASME III-Class 3 permits qualification to a more stringent code subsection, it is permissible to provide ASME III-Class 2 (Ref. 6) or ASME III-Class 1 (Ref.9) analysis for this purpose. ANSI B31.7 (Ref. 8) is the predecessor to ASME III-Class 1 and is, therefore, similarly applicable.

ASME III-Class 1 has considerably higher allowable stresses for material such as ASTM A106 Grade B. However, this is applicable only if ASME III-Class 1 stress analysis is performed. Note that ASME III-Class 1 analysis provides design rules for rigorous evaluation of fatigue life and must be used if the piping is justified on that basis.

2.4 Conclusion

It was concluded that the WPPSS diesel generator piping design utilizes the philosophy and intent of ASME III - Class 3 design (Ref. 2) to provide analytical justification of piping design acceptability. The other above referenced codes (References 3, 6, 7, 8 & 9) were also judiciously considered where applicable, as described in Section 3.0.

3.0 ACCEPTANCE PHILOSOPHY

The intent and philosophy of ASME III - Subsection ND design rules for Class 3 components (Ref. 2) was utilized as the basis of acceptance. The requirements of other codes and standards (Refs. 3, 6, 7, 8 and 9) were also considered for applicability. The analysis was performed in steps, as follows:

1. Pipe stress analysis was first performed in accordance with the design rules of ASME III - Class 3 (Ref. 2), using conservative assumptions for modeling and stress intensification described in detail in 5.0 (below).

2. If this analysis indicated excessive stresses, then the results were evaluated to determine if relaxing some of the conservatisms could be justified for the particular piping systems being considered.

   For example, it was, at times beneficial to consider the more rigorous, ASME III-Class 1 analysis in an attempt to justify thermal expansion stresses on the basis of adequate thermal fatigue life.

3. If pipe stress was still excessive after relaxing conservatisms, support removal and/or modification was then considered.

4. The applicable piping system was then reanalyzed to reflect the above referenced analytical modification. Or, as an alternative, hand calculations were performed to account for a highly localized effect.

4.0 LOADING CONSIDERATIONS

The pipe stress analysis accounts for all loads due to deadweight, thermal expansion, and earthquake.

The effects of earthquake were determined by dynamic pipe stress analysis utilizing appropriate seismic response spectrum envelopes. As noted in the Diesel Generator Seismic Criteria (Ref. 1), Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE or DBE) were considered. Consistent with Reference 1, a three-directional earthquake was assumed. The effects of each of the vertical and two horizontal earthquakes was first determined by combining across modes by square root sum of squares (SRSS) with closely spaced modes considered by the ten percent method, which is in accordance with Ref. 10. The three directions of earthquake were then combined by SRSS to determine the seismic results. Seismic spectra as well as the appropriate damping values were based on Reference 1.

Based upon data provided in Reference 11, the diesel, its supporting skid and the auxiliary skid have all first mode natural frequencies in the rigid range of the applicable response spectrum. Therefore, consideration of the dynamic amplification of those components was not necessary and the floor spectra was used for all analyses.

The analytical piping model for both thermal and seismic analyses included the pipe supports, which were modeled as springs whose spring constants were based on the as-built pipe support configuration of the Lead Diesel (Comanche Peak), where applicable. When the WPPSS supports could not utilize spring constants from Comanche Peak, either spring constants were developed upon available information, or computer program default spring constants were used.

In addition, to more accurately represent both the flexibility of equipment and its dynamic effect on the piping, the equipment was included in the analytical piping model using cross-sectional properties and component weights derived from the applicable equipment details. However, if a particular piece of equipment was apparently rigid, based on engineering judgement, then that equipment was not included in the analytical model.

5.0 SPECIAL COMPONENT CONSIDERATIONS

This section provides discussions relating the analytical considerations of special configurations and components. These include specialty items such as Dresser and Compression Couplings and pipe flanges, and also includes special configurations such as mitered joints, unreinforced branches, including unreinforced lateral connections, and circumferential buttwelds.

5.1 Mitered Joints

Mitered joints are permitted by ASME III-Class 1, 2 and 3 (Refs. 2, 6, and 9), as well as B31.1 (Ref. 5) and B31.3 (Ref. 7). Flexibility characteristic (h), flexibility factor (k), and stress intensification factor (i), as tabulated in Figure NC-3673.2(b)-1 and Figure ND-3673-2(b)-1 in Ref. 2 and 6, were utilized for ASME III-Class 2 and 3 analyses, respectively.

Furthermore, to assure that the miter joint induced discontinuity stresses were acceptably low, equation 4(c), paragraph 304.2.3 of B31.3 (Ref 7) was evaluated to determine the pressure capacity of the joint as compared with the normal operating pressure of the pipe in question.

5.2 Unreinforced Branches

The use of unreinforced branch connections, including unreinforced lateral connections as used in the WPPSS diesel generator skid mounted piping, is permitted by ASME III-Class 1, 2 and 3, as well as by B31.1 and B31.3.

Flexibility characteristic (h), flexibility factor (k) and stress intensification factor (i), as tabulated in Figure NC-3673.2(b)-1 and Figure ND-3673.2(b)-1 were utilized for ASME III-Class 2 and 3 respectively.

Additional analysis was performed to confirm that the pipe is "self-reinforcing" and that the rules for metal reinforcement requirements set forth in the codes (e.g., ASME III-NC-3643.3, et. al.) were satisfied. It is noted that since the design pressure was small in relation to the actually furnished pipe wall thickness, there was considerable excess wall thickness available for self-reinforcing of the branch penetrations.

5.3 Pressure Retaining Buttwelds

5.3.1 Weld Penetration Considerations

For the seamless on-engine piping, weld only in the bevel region was assumed. No weld penetration in the land region (assumed as 1/16 inch) was assumed.

5.3.2 Weld Joint Capacity

Minimum wall thickness requirements dictated by design pressure (e.g. ASME III-NC-3641.1, Equation (3), et. al.) must be maintained at the circumferential buttwelds, which join adjacent spool pieces.

For the WPPSS diesel generator piping, it was conservatively assumed that the material available for design pressure requirements was equal to the pipe wall thickness minus 3/32 inch, to account for the worst possible minimum weld thickness. Minimum weld thickness to minimum required pipe wall thickness ratios were determined for all of the subject pipe sections. The smallest ratio of (tw/tmin) was found to be 2.0 (or 200 percent of minimum required wall thickness). Thus, these welds always met minimum Code requirements for pressure dependent pipe wall thickness. This excess wall provides adequate generic margin against corrosion. More specific data regarding corrosion is provided in the specific component reports where applicable.

All pipe stress calculations, other than design pressure vs. wall thickness calculations, utilized the nominal pipe wall thickness, since a local thinning of the pipe affects its pressure capacity but has a negligible effect on gross bending stresses. This is consistent with the philosophy of ASME III and ANSI codes.

Applying this philosophy to the circumferential welds, it was thus assumed that for deadweight, thermal expansion and seismic loading stress analysis, the available wall thickness was the nominal wall thickness minus the nominal flat landing of 1/16 inch. The evaluation of stresses at the circumferential buttwelds considered this reduction in section.

If the stresses thus derived were adequately low, then strength capacity of the circumferential weld joints furnished for the subject piping was considered to be adequate.

5.3.3 Stress Intensification Factor

The initial analysis utilized a stress intensification factor (SIF) of 1.8, which was the upper limit specified in ASME III-ND (1974 version including addenda through Summer 1974) Figure ND-3673.2(b)-1 for a mismatch of an as welded buttweld (which is in excess of 0.1., i.e, having a ratio of mismatch to pipe wall thickness [delta/t_n]).

This approach was a conservative necessity. If it could easily be determined that the ratio (delta/t_n) is 0.1 or less, then the code permits an SIF of 1.0 for as welded or flush buttweld. However, since the pipe had independent I.D.,O.D., and out of round tolerances, it was not possible to determine the actual pipe wall mismatch (delta) between two adjacent spools by visual inspection of the outside of the piping. Thus the conservative value of 1.8 was utilized.

5.4 Dresser and Compression Couplings

Dresser Couplings (see Figure 1) and Compression Couplings (see Figure 2) were utilized throughout the WPPSS diesel generator skid mounted piping. These couplings provide a flexible, leak proof seal at the pipe spool piece interface, without pipe threading, or welding, and do not require precise spool piece end preparation or precise piping alignment.

These couplings have an 80 year record of successful service on all kinds of piping such as water mains, sewage treatment, and water filtration piping, and in all branches of the oil industry, and have been used extensively by TDI for other diesel generator installations.

5.4.1 Code Acceptability of Dresser and Compression Couplings

ASME III-NC-3649 (for Class 2 components) and ASME III-ND-3649 (for Class 3 components) permit the use of pressure retaining products not specifically covered in the code, which are shaped, proportioned, and sized similar to components that have been proven satisfactory by successful performance under comparable service conditions.

By virtue of their long record of satisfactory service for moderate pressure/temperature systems of this type of application, the Dresser Couplings and the Compression Couplings meet the intent of ASME-III Class 2 and Class 3 (Refs. 2 and 6) and were therefore acceptable components.

5.4.2 Coupling Validation

1. Selection

The Dresser catalog specifies limiting pressures and temperatures for the various couplings. The subject service conditions were evaluated against these requirements and some couplings, because of the gaskets supplied, were slightly marginal with respect to the temperature requirements. For these couplings, replacement with an upgraded model was specified if leaks developed.

2. Displacement Verification

When acceptable piping/pipe support results are obtained, the relative translations and rotations of the joined pipes were compared to the vendor allowables for the coupling to validate the analysis.

5.4.3 Effects of Couplings on Pipe Stress Analysis

1. Pressure Effects

Pressure integrity of the piping is achieved by wedging the coupling gasket against the outside of the pipe and into the mating fitting (Reference Figures 1 and 2). However, this configuration permits axial pipe movements of the adjacent pipe spool pieces. Thus, when the pipe is pressurized, it would tend to slip out of the coupling and separate, if some external axial anchorage were not also furnished. Pipe supports and terminal end connections were relied upon to prevent slipping. The pipe stress analysis included the effects of these resulting unbalanced pressure forces.

2. Constraint of Thermal Expansion

As shown in Figures 1 and 2, a gap is intended to be maintained between the two pipe spool pieces during installation. This would accommodate a modest amount of thermal pipe expansion. However, if this gap is not maintained during the installation of the piping, then the thermal expansion relief is partially negated.

Couplings without Tie Rods

Pipes joined by couplings have only the gasket and its frictional capacity to provide any mutual stiffening across the joint. Since this is very low, the coupling connection was analyzed as completely free to rotate and translate relatively.

Couplings with Tie Rods

Couplings with tie rods were addressed according to the tendency of the joined pipes to separate or close the original installations gap under various loads.

For the case where the joined pipes moved to decreased the installation gap under thermal and internal pressure loadings, i.e., the tie rods becoming ineffective, the analyses were performed allowing all relative translations and rotations.

To account for a seismic event on a cold, unpressured pipe, a second dynamic analysis was performed with a non-zero axial stiffness at the couplings and the results enveloped.

For the case where the joined pipes loaded the tie rods in tension, the benefits of the original installation gap are essentially negated. Accordingly, the tie rods were then double-nutted to take advantage of the mutual stiffening effects of the joined pipes.

3. Seismic Interaction at the Couplings

Examination of Figures 1 and 2 indicates that modest translations and rotations between the two adjacent piping spool pieces are possible, by virtue of the soft gaskets, and the gaps within the couplings. For seismic analysis, it is not conservative to neglect this flexibility.

In order to account for this, seismic pipe stress analysis first conservatively assumed the piping systems to be completely separated at the coupling, thus taking no credit for any mutual stiffening across the coupling. If the seismic stresses were acceptable, then no further evaluation was performed.

5.5 Pipe and Equipment Supports

Pipe and equipment supports were qualified on the basis of plant specific operating history as well as Impell's experience with the Shoreham and Comanche Peak Diesel Generators. Engineering judgement was used in the qualification of supports. Since as-built details for supports were not provided, it was assumed that supports were installed as originally designed by TDI. Where previous support problems existed, either on the Comanche Peak engine or on similar engines, generic-type recommendations for modifications were made. Where piping analysis deemed support modifications (e.g., addition or removal of supports) necessary, recommendations to incorporate such changes were included in the final reports. Where there was no history of problems with a support nor any analytical basis for modification, that support was judged adequate for its intended purpose.

5.6 Pipe Flanges

5.6.1 Standard Flanges

Flanges fabricated to standards listed in ASME III-NC-3132-1 (for Class 2) and ND-3132-1 (for Class 3) are acceptable for ASME III Class 2 and 3. For these flanges the established pressure/temperature rating was first compared with operating pressure/temperature to evaluate the flange selection.

Since the operating pressures for the subject piping systems were modest, the flange had excess capacity to carry mechanical loads imposed on the flange. This was confirmed by conservative hand calculations using techniques outlined in ASME III - Subsection ND 3658.

5.6.2 Non-Standard Flanges

At a number of locations within the WPPSS Diesel Generator skid mounted piping, square or rectangular, flat plate flanges were utilized. These flanges were analyzed as flat plates, using conservative assumptions.

5.6.3 Flange Bolt Pipe Support Attachments

At a number of locations pipe support straps were connected to piping at pipe flanges by means of two (2) flange bolts. Since these bolts have the multiple duty of providing pressure closure and flange continuity, as well as serving as a pipe support attachment, they required special evaluation for adequacy. These flange bolts were evaluated on the following basis:

If the flange bolts are properly torqued, providing ample precompression at the flange/pipe support strap, then there is frictional resistance to transmit load. If this frictional resistance capacity is greater than the actual applied force, then the bolt is loaded only in tension. It does not therefore realize any of the transverse load, or accompanying bending which is transmitted to the flange assemlby by the pipe support strap plate.

The bolt frictional capacity, based on Transamerica Delaval bolt torque recommendations, (Ref. 12), was compared to the strap load, and the connection was adequate to transfer shear without bolt bending provided the frictional capacity is at least 1.5 times the support load. If this criteria was not met, then higher strength bolts were specified, such that an increased bolt torque could be applied, yielding higher pretension and thus ensuring a greater frictional capacity.

6.0 REFERENCES

1. Specification 9779-53, Revision 20, "Bidding Documents and Plans and Specifications.

2. American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, "Rules for Construction of Nuclear Power Plant Components" (ASME III) Subsection ND Class 3 Components (ASME III-Class 3).

3. American National Standards Institute (ANSI) Document ANSI/ASME B31.1, "Power Piping" (B31.1).

4. Diesel Engine Manufacturers Association (DEMA), "Standards and Practices for Low and Medium Speed Stationary Diesel and Gas Engines," 1972.

5. American Bureau of Ships, "Rules for Buiding and Classing Steel Vessels," 1976.

6. ASME III, Subsection NC, Class 2 Components (ASME III-Class 2).

7. ANSI document ANSI/ASME B31.3, "Chemical Plant and Petroleum Refinery Piping" (B31.3).

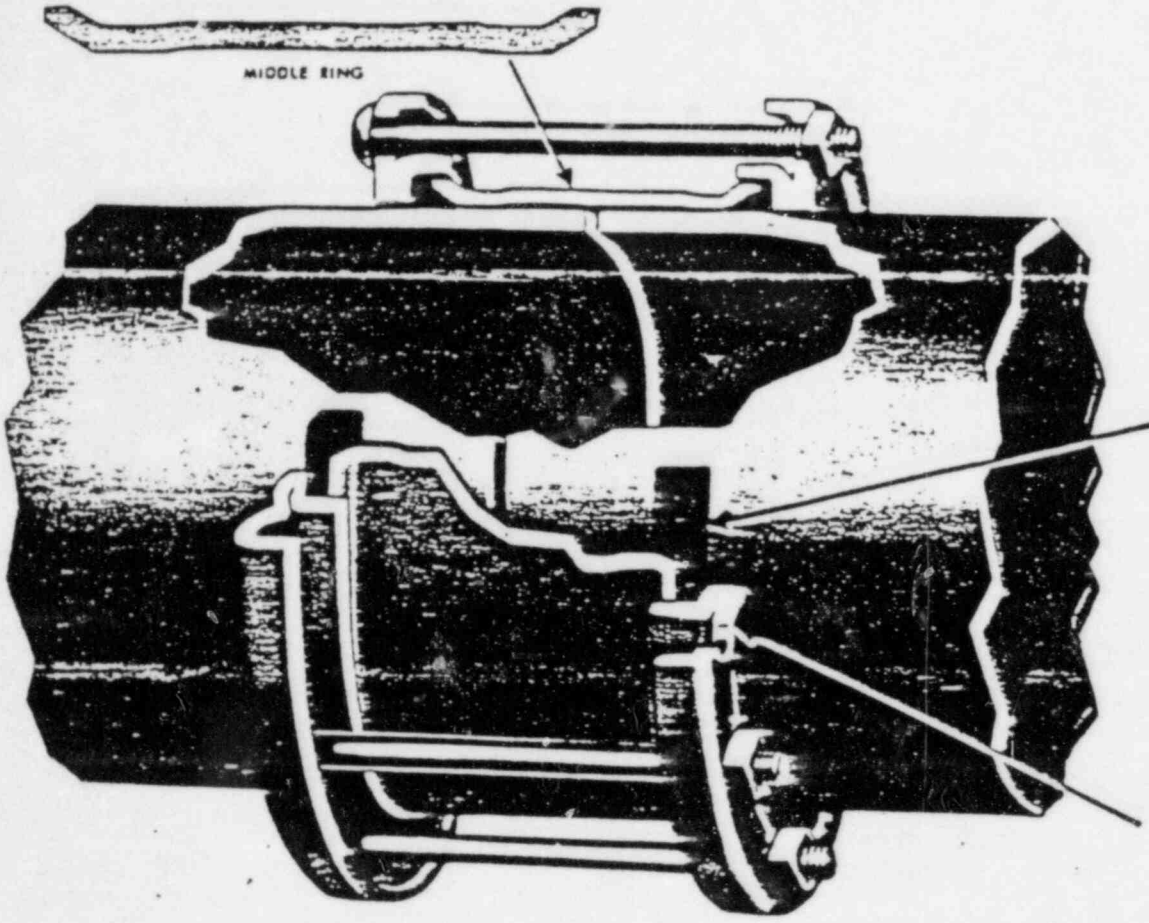
8. ANSI B31.7, "Nuclear Power Piping" (B31.7).

9. ASME III, Subsection NB, Class 1 Components (ASME III-Class 1).

10. NRC Regulatory Guide 1.61, October, 1973.

11. Seismic Qualification Report on Washington Public Power Supply System Nuclear Projects No. 1 and 4, Prepared by Structural Dynamics Research Cooperation for Delaval Turbine Inc. November 18, 1977.

12. TDI Instruction Manual, Volume I, Appendix IV "Model DSRV-16-4 Diesel Engine/Generator".



Style 38 and Style 40 Coupling Gasket cross section.

This section furnished for Stab-38 and Stab-39 Couplings.

Cutaway view of Dresser Coupling, showing working principle and illustrating shape and relative position of component parts. Insets show details of parts.

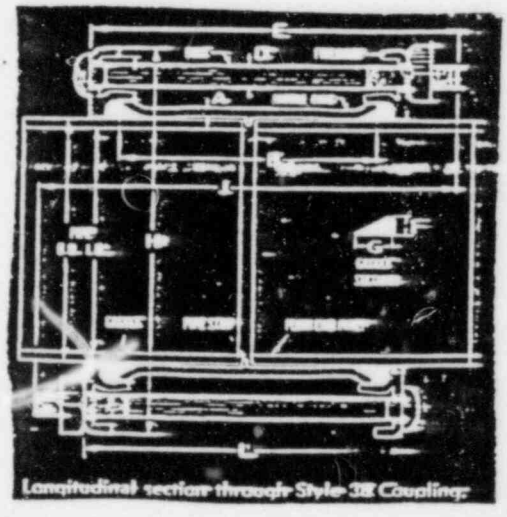
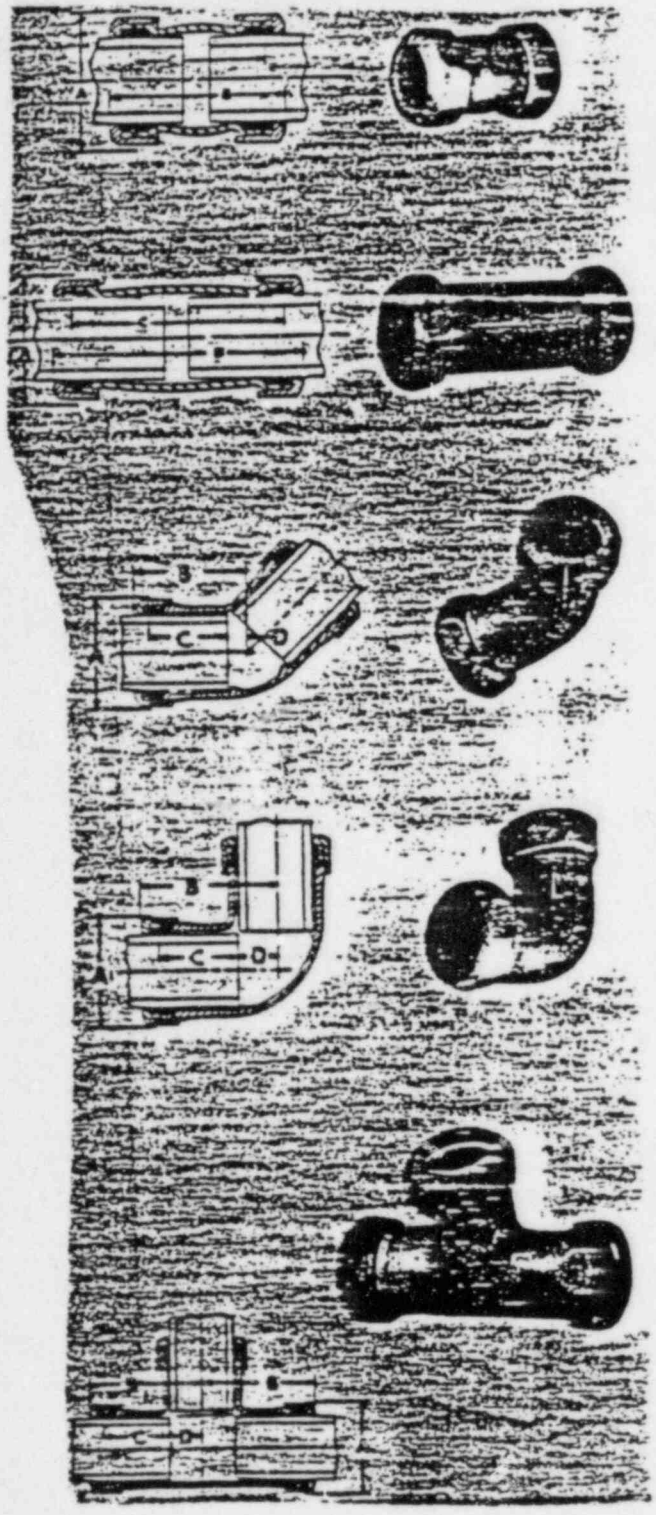

Longitudinal section through Style 38 Couplings

FIGURE 1

DRESSER COUPLING



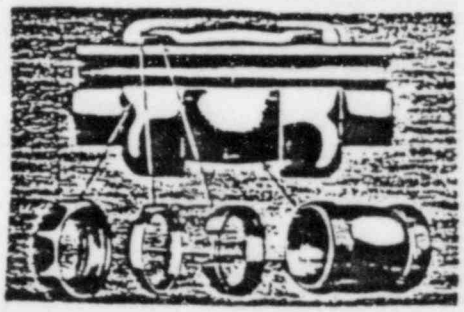


FIGURE 2

COMPRESSION COUPLING