

TDI DIESEL GENERATOR
DESIGN REVIEW
AND QUALITY REVALIDATION
REPORT

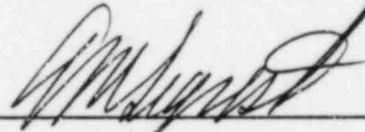
Prepared For

TEXAS UTILITIES GENERATING COMPANY
COMANCHE PEAK STEAM ELECTRIC STATION - UNIT 1

By

TDI DIESEL GENERATOR OWNERS GROUP

Revision 2
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APPENDIX - II
GENERIC MAINTENANCE MATRIX

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GENERIC MAINTENANCE MATRIX

APPENDIX - II

OVERVIEW AND DEFINITIONS

OPERATING AND STANDBY SURVEILLANCE
PARAMETERS

PART A

TDI OWNERS GROUP
GENERIC MAINTENANCE AND SURVEILLANCE PROGRAM

APPENDIX - II

I INTRODUCTION

The purpose of this appendix is to provide the TDI Owners 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 and including subsequent testing and inspections performed following the review conducted by the original program. This appendix is intended to enhance 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. The basis of this matrix is formed by the following:

- Owners Group Technical Staff review of TDI Instruction Manuals, SIMs, and TDI correspondence on specific components.
- Technical Staff input regarding the adequacy of recommendations found in sources mentioned above.
- Additional maintenance recommendations identified during the DR/QR review.
- Results of subsequent testing and surveillance (i.e., Shoreham EDG103 750-hour endurance run and subsequent engine teardown) performed following the review conducted during the original program.
- Additional review by the Owners Group representatives.

It should be noted that this revision in some cases modifies the original program results based on this additional information and review.

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. This schedule should be followed as closely as the operating conditions will permit. This maintenance service as specified supersedes previous general maintenance requirements, but is separate and does not supersede Quality Revalidation and/or modifications previously recommended. The schedule details specific components requiring maintenance on a regular basis. This schedule separates the maintenance activities into frequencies as set forth in the subsequent list of definitions.

Inspections, as outlined in this maintenance schedule, are to be performed and parts refurbished or replaced as required by the program or deemed necessary by the inspection. Any adverse findings shall be investigated and corrective action, including amended inspection frequencies, shall be implemented unless sufficient justification is present to do otherwise.

This generic matrix, Parts A, B, C together with Part D entitled "Site-Specific Maintenance Matrix" and the sources defined in Section II form the TDI Maintenance Program. Note that component numbers used in the generic matrix are for Texas Utilities' Comanche Peak Steam Electric Station - Unit 1. Part E provides a cross reference to identify corresponding components for other engines. Also note that a blank in the cross reference signifies that a component is not on a particular engine and thus that Owner would not perform that maintenance item.

Tables 1 and 2 of Part A provide engine operating and standby surveillance parameters and frequencies. It is recommended that the utility address these tables in its operating and monitoring programs. Table 1 addresses operating parameters and is not duplicated in the maintenance schedules; these parameters are to be recorded and/or checked during the monthly testing and any other period of operation. Table 2 addresses the standby parameters that occur on a daily frequency and are not duplicated in the maintenance schedules.

IV. DEFINITION OF TERMS

1. Overhaul Frequency

- a) A complete engine teardown and inspection will be performed every 10 years. The utility has the flexibility to inspect one engine/reactor unit at the EOC prior to 10 years and the other engine at the EOC following 10 years. Alternately for PWR units, the inspection may be performed coincident with the 10-year reactor vessel in-service inspection. This will permit both engines for each unit to be disassembled in parallel since one engine will not have to remain in service with the reactor vessel off loaded. (For reactor units having three engines, the inspections are to be carried out as above with the third engine to be inspected at the second EOC following 10 years). The 10-year interval will typically be taken from issuance of the Low Power Operating license or from subsequent teardown and inspection for plants already in operation.

- b) A one time inspection will be performed at the EOC closest to 5 years. For a unit, one engine may be inspected at the EOC prior to 5 years and the other at the EOC after 5 years to minimize plant outage length. (For reactor units having three engines, the inspections are to be carried out as above with the third engine to be inspected at the second EOC following 5 years). This inspection will generally involve the same components as the 10-year teardown; however, only a sample of items for some components will be inspected as set forth in the maintenance schedule. During this 5-year inspection any significant adverse findings of a particular component will result in an inspection of all such components of that engine to determine any adverse trends. Favorable findings will result in reassembly of the engine for service.
2. Daily Frequency - To be performed once per day.
 3. Monthly Frequency - To be performed once in a month; normally during, before, or after test run per plant Technical Specifications.
 4. EOC - (End of Cycle) - To be performed once during outage for refueling.
 5. Alternate EOC - To be performed once every other outage for refueling.
 6. Five Years - To be performed once at the EOC occurring nearest to the end of a recurring 5-year period.
 7. As Required - To be performed as often as good maintenance, site procedures, manufacturer's recommendations, or experience dictate as determined by site personnel.
 8. Maintenance - Monitoring and/or surveillance on a periodic frequency to assure the component will perform its intended function in a safe reliable manner.
 9. Accessible - Any item on which the required function can be performed without disassembly of an engine component. Removal of defined access cover is not considered disassembly.
 10. Appropriate NDE - Nondestructive examination selected by site personnel that is most suitable to obtain the information sought by an individual inspection item; choice of NDE shall be made to assure that the technique will detect indications consistent with the acceptance criteria.

TABLE 1

Diesel Engine Operating Surveillance Parameters and Frequency

<u>Component</u>	<u>Frequency</u>
1) Lube Oil Inlet Pressure to Engine	Log hourly
2) Lube Oil Filter Differential Pressure	Log hourly
3) Lube Oil Temperature (engine inlet and outlet)	Log hourly
4) Lube Oil Sump Level	Log hourly
5) Turbocharger Oil Pressure	Log hourly
6) Fuel Oil Filter Differential Pressure	Log hourly
7) Fuel Oil to Engine Pressure	Log hourly
8) Fuel Oil Day Tank Level	Check hourly
9) Jacket Water Pressure (engine inlet)	Log hourly
10) Jacket Water Temperature (in, out)	Log hourly
11) Engine Cylinder Temperature Exhaust - All (If temperature in any one cylinder exceeds 1050°, refer to MP-022/023 Item 7.)	Log hourly
12) Manifold Air Temperature (RB, LB for DSRV Engines)	Log hourly
13) Manifold Air Pressure (RB, LB for DSRV Engines)	Log hourly
14) Starting Air Pressure (RB, LB for DSRV Engines)	Check hourly
15) Crankcase Vacuum	Log hourly
16) Engine Speed	Log hourly
17) Hour Meter	Log hourly

TABLE 1 (Cont'd)

Diesel Engine Operating Surveillance Parameters and Frequency

<u>Component</u>	<u>Frequency</u>
18) Kilowatt Load	Log hourly
19) Visual Inspection for Leaks, etc.	Check hourly

TABLE 2

Diesel Engine Standby Surveillance Parameters and Frequency

<u>Component</u>	<u>Frequency</u>
1) Lube Oil Temperature (in, out)	Log daily
2) Lube Oil Sump Level	Log daily
3) Check Operation of Lube Oil Keep-Warm Pump Motor	Daily
4) Monitor Lube Oil Keep-Warm Strainer and/or Filter Differential Pressure	Daily
5) Perform a visual inspection for leakage of the Lube Oil Heat Exchanger. Verify that no leakage through the leak-off ports of the lantern ring is present.	Daily
6) Fuel Oil Day Tank Level	Log daily
7) Jacket Water Temperature (in, out)	Log daily
8) Perform a visual inspection for leakage at packing for Jacket Water Heat Exchanger whenever the engine is in the emergency STANDBY mode. Verify that no leakage through the leak-off ports of the lantern ring is present.	Daily
9) Governor Oil Level	Daily
10) Verify proper oil level of generator pedestal bearing	Daily
11) Starting Air Pressure	Log daily
12) Drain air receiver float traps and/or drain Starting Air Storage Tank and monitor the quantity of moisture produced. If quantity of moisture is excessive, correct immediately.	Daily

TABLE 2 (Cont'd)

Diesel Engine Standby Surveillance Parameters and Frequency

<u>Component</u>	<u>Frequency</u>
13) Check Operation of Compressor Air Traps	Daily
14) Test Annunciators	Before Engine Operation
15) Check Alarm Clear	Before Engine Operation
16) Inspect for Leaks	Daily
17) Visually inspect intercooler for external leaks including intake manifold drain connection.	Daily

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APPENDIX - II
GENERIC MAINTENANCE MATRIX

PART B
PHASE I COMPONENTS

GENERIC MAINTENANCE MATRIX - PHASE I

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
MP-022/23	Turbocharger	1. Measure vibration and check with baseline data.		X				To be accomplished during 24-hour test run.
		2. Inspect impeller/diffuser and clean if necessary.				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.
		4. Perform visual and blue check inspections of the thrust bearing.				X		Note: Thrust bearing inspection should also be performed after experiencing each 40 non-prelubed (automatic) fast starts. In addition, a one time inspection should be completed after the first 100 engine starts.
		5. Disassemble, inspect, and refurbish.				X		Note: During reassembly ensure that capscrews are properly installed with the recommended torque. If QR inspection was performed prior to accumulating significant hours (i.e., the number of hours accumulated during plant preoperational testing, approximately 100 hours), the turbochargers should be reinspected at the next EOC.

GENERIC MAINTENANCE MATRIX - PHASE I

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		6. The nozzle ring components and inlet guide vanes should be visually inspected for missing parts or parts showing distress. If such conditions are noted, the entire ring assembly should be replaced.				X		Also perform a visual inspection on one turbo-charger per nuclear unit at each EOC. Note: Discontinue inspection with appropriate re-design.
		7. Monitor inlet temperature to ensure gas temperature does not exceed manufacturer's recommendation of 1200°F if exhaust temperature for any cylinder exceeds 1050°F (Refr: Table 1).						Monitoring may be performed using permanent in-line thermocouple, strap-on thermocouple, heat gun, or other suitable means that has been appropriately tested and calibrated per plant procedures. Note: Also perform monitoring any time the engine operates in an unbalanced condition.
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 further before the engine is allowed to return to service. The mating surfaces of the base and cap shall be thoroughly cleaned with solvent before any reassembly. Perform on EOC basis for 3 cycles, then overhaul provided there are satisfactory results. Note: 3 EOC inspections may be eliminated by performing a metal analysis to confirm consistent to class 40 grey iron requirements; performing analysis does not eliminate need for overhaul inspections.

GENERIC MAINTENANCE MATRIX - PHASE I

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
02-305C	Main Bearing Caps - Studs and Nuts	<p>1. The mating surfaces at the bearing cap/saddle interface should be inspected when disassembled to ensure the absence of surface imperfections that might prevent tight boltup.</p> <p>Note: Upon removal of bearing caps, clean mating surfaces with a solvent prior to reassembly of the caps to the base.</p>						
02-310A	Crankshaft	See site specific recommendations						
02-315A	Cylinder Block	See site specific recommendations						
02-315C	Cylinder Liners	<p>1. Perform a visual inspection of liners for progressive wear.</p>						To be performed for first 2 EOCs following piston removal; then discontinue until next piston removal. Boroscopic inspection is acceptable if heads are not removed. Complete TDI Inspection and Maintenance Record Form No. 315-1-1 as applicable, TDI Instruction Manual, Volume I, Section 6.
02-340A/B	Connecting Rods, Bushings and Bearing Shells (Generic)	<p>1. Inspect and measure all connecting rod bearing shells to verify lube oil maintenance, which affects wear rate.</p>					X	Complete TDI Inspection and Maintenance Record Form No. 340-1-1 as applicable, TDI Instruction Manual, Volume I, Section 6, Appendix III for clearance values. Perform inspection at 5 years, on items accessible, consistent with Item 2 of this component.

GENERIC MAINTENANCE MATRIX - PHASE I

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		2. Inspect and measure the connecting rods. Note: Perform inspection and measure four connecting rods for DSRVs and two for DSRs at random at one time 5-year inspection.					X	Complete TDI Inspection Maintenance Record Form No. 340-2-1, -2 as applicable, 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 as required.
		4. All connecting rod bolts, nuts, and washers should be visually inspected, and damaged parts should be replaced. The bolts should be MT inspected to verify the continued absence of cracking. No detectable cracks should be allowed at the root of the threads.					X	Perform inspection at 5 years, on items accessible, consistent with Item 2 of this component.
		5. During any disassembly that exposes the inside diameter of a rod-eye (piston pin) bushing, the surface of the bushing should be LP inspected to verify the continued absence of linear indications in the heavily-loaded zone width ± 15 degrees of the bottom dead-center position.						Perform inspection, as required and on items accessible, consistent with Item 2 of this component.
02-340 A/B DSRV's only	Connecting Rods, Bushings and Bearing Shells	6. Measure the clearance between the link pin and link rod. This clearance should be zero i.e., no measurable clearance when the specified bolt torque of 1,050 ft-lbs is applied.						To be performed once for each connecting rod.

GENERIC MAINTENANCE MATRIX - PHASE I

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		7. At the overhaul, visually inspect the rack teeth surfaces for signs of fretting and at one time 5-year inspection for rods disassembled.					X	
		8. Inspect mating surfaces to verify that the minimum manufacturers' recommended percent contact surface is available.						To be performed once for new and/or replacement parts.
		9. If connecting rod bolt stretch was measured ultrasonically during reassembly following the preservice inspection, the lengths of the two pairs of bolts above the connecting rod should be remeasured ultrasonically before the link rod box is disassembled. If ultrasonic measurement was not previously used, begin use at next inspection that accesses the connecting rods. Measure bolt stretch before disassembly.					X	Also to be performed at any time the connecting rod is disassembled. Perform inspection at 5 years, on items accessible, consistent with Item 2 of this component.
		10. All connecting rod bolts should be visually inspected for thread damage (galling) and the two pairs of connecting rod bolts above the crankpin should be MT inspected to verify the absence of cracking. All washers used with the bolts should be examined visually for signs of galling or cracking and replaced if damaged.					X	Also to be performed at any time the connecting rod is disassembled. Perform inspection at 5 years, on items accessible, consistent with Item 2 of this component.
		11. A visual inspection should be performed of all external surfaces of the link rod box to verify the absence of any signs of service-included distress.					X	Also to be performed at any time the connecting rod is disassembled. Perform inspection at 5 years, on items accessible, consistent with Item 2 of this component.

GENERIC MAINTENANCE MATRIX - PHASE I

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		12. All of the bolt holes in the link rod box should be inspected for thread damage (galling) or other signs of abnormalities. Bolt holes subject to the highest stresses (the pair immediately above the crankpin) should be examined with an appropriate non-destructive method to verify the absence of cracking. Any indications should be recorded for evaluation and corrective action.					X	Also to be performed at any time the connecting rod is disassembled. Perform inspection at 5 years, on items accessible, consistent with Item 2 of this component.
02-341A	Pistons	1. Inspect and measure skirt and piston pin. This item assumes that AE skirts are installed. For other types, see site-specific recommendations.					X	Complete TDI Inspection and Maintenance Report Form No. 341-1-1 as applicable, TDI Instruction Manual, Volume I, Section 6. Use Volume 1, Section 8, Appendix III for clearance values. To be performed at 5-year interval on sampling basis consistent with Component 02-340A/B-Connecting Rods.
02-360A	Cylinder Head	1. Visually inspect cylinder heads (all cylinders). Note: Inspection by boroscope is acceptable.					X	Complete TDI Inspection and Maintenance Record Form No. 360-1-1 as applicable, TDI Instruction Manual, Volume I, Section 6 - one sheet for each head. To be performed at 5-year interval on sampling basis consistent with Component 02-340 A/B - Connecting Rods.
		2. Record cold compression pressures and maximum firing pressures.			X			If so indicated - remove cylinder heads, grind valves, and reseat. Refr: TDI Instruction Manual, Volume I, Section 6.

GENERIC MAINTENANCE MATRIX - PHASE I

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		3. Blow-over the engine at least 4 hours but not more than 8 hours after engine shutdown. The cylinder cocks should be open for detection of water leakage into the cylinders. A second air roll should be performed in the same manner approximately 24 hours after engine shutdown. In addition, the engine should be air rolled shortly before any planned start.						In the event water is detected, the cylinder head should be replaced or returned to the vendor for repair. Delete post-run air roll requirements for engines with Group III heads after one cycle with positive inspection results.
		4. Visually inspect the area around the fuel injection port on each cylinder head during the normal monthly run for signs of leakage.	X					If water leakage is detected, the head(s) should be replaced.
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.
		2. Visually inspect tubing lengths for fuel oil leaks or cracks if tubing is unshrouded. If shrouded, fuel oil leakage can be detected at the leak-off ports in the base nuts, which are provided for this purpose.		X				Fitting inspection for leaks to be performed at engine operation following shutdown. Subsequent inspections to be performed periodically as indicated. Unshrouded tubing, used as replacement, should be fully inspected consistent with FaAA NDE Procedure 11.10 prior to bending.

GENERIC MAINTENANCE MATRIX - PHASE I

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
02-390G	Rocker Arm Capscrews, Drive Studs (Pop Rivets)	<ol style="list-style-type: none"> 1. Verify capscrew torque values during QR inspection. If not performed at QR, verify at next EOC, then as required at reassembly. 2. Verify that rocker arm drive studs are intact and tight during QR inspection or EOC1, then as required at reassembly. 						Use TDI Instruction Manual, Volume I, Section 8, Appendix IV for proper torque values.
02-425A	Jacket Water Pump - Gear	<ol style="list-style-type: none"> 1. Visually inspect jacket water pump gear for chipped or broken teeth, excessive wear, pitting or other abnormal conditions. 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. At next teardown, verify impeller is one piece, (i.e., without a bore insert). If it is not a one piece impeller, replace. 3. It is recommended that the castle nut that drives the external spline on its taper have minimum and maximum torque values of 120 ft-lbs and 660 ft-lbs respectively for DSRVs and a maximum torque value of 77 ft-lbs for DSRs. 				X	X	Any abnormal situations or indications of progressive pitting should be reported for an engineering evaluation. For engines with less than 750 hours, also inspect by EOC2. 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.

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APPENDIX - II
GENERIC MAINTENANCE MATRIX

PART C
PHASE II COMPONENTS

GENERIC MAINTENANCE MATRIX - PHASE II

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
F-068	Intercoolers	1. Record the following temperatures during the monthly surveillance test of the engine: exhaust from cylinders and jacket cooling water supply. Compare these results with similar data from previous month to establish whether the trend is sufficient to warrant further action.	X					
		2. Inspect shell and tube sides, and clean as required.						Inspect at EOC1 and EOC3 to verify Item 1 results are valid.
		3. Verify intake manifold drain connection is open and clean.	X					Note: Refer to TDI SIM to be issued subsequent to March 1986.
		4. Perform leakage test of water side boundary for gross degradation.				X		
CP-101A	Emergency Generator	1. Check operation of brushes and slip rings by visual examination during operation.	X					
		2. Inspect all accessible parts of the generator, and clean as required.			X			
		3. Megger rotor and stator.			X			
		4. Verify that space heaters are on with engine shutdown.	X					
		5. Measure vibration and check against baseline data.			X			
CP-101B	Emergency Generator Pedestal Bearing	1. Drain, flush, refill bearing housing.			X			
		2. Measure bearing housing insulation resistance.			X			

GENERIC MAINTENANCE MATRIX - PHASE II

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		3. Disassemble and inspect bearing and check clearances.					X	
CP-102	Emergency Generator Control Panel	1. Inspect panel for cleanliness and clean as required.		X				
		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.						To be performed per appropriate site intervals for similar equipment.
		6. Bridge rectifier assembly.						Note: Inspections may be deleted after modifications as prescribed in DR/QR Report.
		a. Inspect the temperature sensitive label placed on the most visible face of the hexagonal body of the diodes. The label shall be inspected before and after each running of the engine.		X				If the label permanently blackens, the maximum temperature of the diode has been exceeded, requiring an electrical inspection of the diode and an inspection of the mounting threads of the heat sink and diode. Replace the diode and the heat sink as needed and assure that proper mounting tightness of 300 in-lbs and proper thread condition is maintained.

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<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		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 SCR heatsinks for signs of relative motion.			X			Retighten any loose connections, remove old glyptol, and reapply if connections are retightened.
		7. Adjustment potentiometers - 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			If adjustments are needed, remove glyptol, and reapply when the adjustment procedure is complete.
		8. Printed circuit boards - check for cleanliness and proper mounting of components.			X			Report any abnormal conditions to engineering for evaluation.
		9. Implement a procedure to monitor generator voltage at start. A manual reset of the exciter must be performed in the event of a failed start.						This recommendation is required until such time that modifications are made to the time delay relay latching logic in the generator control.
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.
		2. During initial startup after a major reassembly of lube oil piping, abnormal lube oil pressure excursions should be investigated and remedial action taken until excursions subside.						

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<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
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 timing and the specified ability to start the engine.
		2. Ensure that the starting air manifold vent is open and unobstructed by noting the escape of air during engine startup.	X					Note: Inspect at EOC1 for sites that did not perform QR Inspection after plant pre-operational testing.
02-307B	Lube Oil Tubing and Fittings - Internal	1. Check accessible tubing for dents or crimps after performing maintenance in that area.						To be performed as required.
02-310B	Main Bearings Shells	1. Inspect and measure thickness of all main bearing shells. 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	Note: Perform inspection on bearings 5 & 7 for DSRVs and mains between 5 & 6, and 6 & 7 for DSRs on one engine/station at EOC2. At one time 5-year inspection, inspect bearings 3 through 8 inclusive. Complete TDI Inspection and Maintenance Record Form No. 310-2-1 as applicable, TDI Instruction Manual, Volume I, Section 6 - one sheet for each main bearing. Use Volume I, Appendix III for clearance values. Also inspect when removed consistent with inspections required for Component 02-310A.

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<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
02-310C	Thrust Bearing Ring	1. Measure thrust bearing ring clearance by "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 ° 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, at least one bearing must be replaced. Bearings should also be replaced if they are cracked or gouged.
		2. Visually inspect thrust bearing ring for signs of wear or degradation.					X	To be performed at 10-year interval only (i.e., not at one time 5-year inspection).
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 after 185 hours of at or near full load operation may be used to justify the discontinuation of such inspection until an overhaul. For engines with less than 185 hours operation at or near full load, inspect at each EOC until exceeds 185 hours.
		2. 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 corrective action.
		3. Check internals of block and base for leaks.			X			

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02-317A&B	Water Discharge Manifold - Jacket Water Discharge Piping, Couplings and Seals	1. Visually inspect for leaks.	X					
02-341B	Piston Rings	1. Inspect and measure piston replacement rings.						Complete TDI Inspection and Maintenance Record Form No. 341-2-1 as applicable, TDI Instruction Manual, Volume I, Section 6. Use Volume I, Section 8, Appendix III for clearance values. To be performed as required.
02-341C	Piston Pin Assembly	1. Visually inspect for chrome plate damage. Replace pins which show chipped or blistered chrome. Note: All new or replacement pins should be LP or MP inspected before installation in Owners Group engines.					X	Also to be performed one time at the 5-year inspection on sampling basis consistent with Component 340A/B - Connecting Rods. Note: MT may cause FE particulate accumulation.
		2. Inspect end plugs and reroll or replace any that are loose.					X	Note: This inspection is also to be performed one time at 5-year interval on sampling basis consistent with Component 340A/B - Connecting Rods.
02-345A	Intake and Exhaust Tappet Assembly	1. Visually inspect intake and exhaust tappet assembly condition, and verify that cam rollers are free to rotate and that there is no noticeable clearance between the cam rollers and the roller pins. Do this by manually checking for excessive motion and visually observing for abnormalities on the mating surfaces.					X	Complete TDI Inspection and Maintenance Report Form No. 345-1-1 as applicable, TDI Instruction Manual, Volume I, Section 6. Refr: TDI Instruction Manual, Volume I, Maintenance Schedule. Perform an additional inspection by EOC2 on exposed or accessible assemblies. Also perform one time at 5 years consistent with Component 02-340 A/B Item 2.

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02-345B	Fuel Tappet Assembly	1. Visually inspect fuel tappet assembly condition, and verify that cam rollers are free to rotate and that there is no noticeable clearance between the cam rollers and the roller pins. Do this by manually checking for excessive motion and visually observing for abnormalities on the mating surfaces.					X	Complete TDI Inspection and Maintenance Report Form No. 345-1-1 as applicable, TDI Instruction Manual, Volume I, Section 5. Also perform one time at 5 years consistent with Component 02-340 A/B Item 2. Perform an additional inspection by EOC2 on exposed or accessible assemblies.
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. Any corrective measures shall be implemented as indicated by this analysis. Signs of spalling shall result in immediate replacement of the cam. Perform an additional inspection by EOC2 on exposed or accessible assemblies. Refr: TDI Instruction Manual, Volume I, Maintenance Schedule. Also to be performed one time at 5 years consistent with Component 02-340 A/B.
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 as applicable, TDI Instruction Manual, Volume I, Section 6. Use Volume I, Section 8, Appendix III for clearance values.

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02-350C	Cam Gear	<ol style="list-style-type: none"> 1. Visually inspect cam gear for chipped or broken teeth, pitting, excessive wear, or other abnormal conditions. At this inspection, the gear is in immediate proximity to the spray nozzle which should also be visually inspected. 2. Measure gear backlash. Note: If cam gear hub is removed, it is recommended that the nut be relocked at the position corresponding to the torque of 70±20 ft-lbs. Insertion of the cotter pin must be accomplished at a torque > 50 ft lbs and < 90 ft -lbs. If this is not possible, another bolt, nut or washer should be used. 				X		<p>Also at one time 5-year inspection for Component 02-340A/B measure clearances per TDI on one bearing housing/camshaft.</p> <p>For engines with less than 750 hours, also inspect at EOC2.</p>
02-355A	Crank to Lube Oil Pump Gear	<ol style="list-style-type: none"> 1. Visually inspect crankshaft to lube oil pump gear for chipped or broken teeth, excessive wear, or progressive pitting or other abnormal conditions. 				X		<p>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 clearance values.</p> <p>Note: Refer to TDI SIM to be issued subsequent to March 1986. Also to be performed one time at 5 years consistent with Component 02-340 A/B.</p> <p>Any abnormal situations or indications of progressive pitting should be reported for an engineering evaluation. For engines with less than 750 hours, also inspect by EOC2.</p>

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		2. Measure gear backlash.					X	Complete applicable sections of TDI Inspection and Maintenance Record Form No. 355-1-1, TDI Instruction Manual, Volume I, Section 6. Use Volume 1, Section 8, Appendix III-1 for clearance values.
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. For engines with less than 750 hours, also inspect at EOC2.
		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 70±20 ft-lbs. Insertion of the cotter pin must be accomplished at a torque > 50 ft-lbs and < 90 ft-lbs. 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 Manual, Volume I, Section 6. Use Volume 1, Section 8, Appendix III-1 for clearance values.
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. Refr.: TDI SIM 360.
		2. Inspect the piston, cap, guide, and housing sliding surfaces to evaluate wear or corrosion.			X			
02-360B	Cylinder Head - Intake and Exhaust Valves	1. Visually inspect intake and exhaust valves, keepers, stems and seats for wire drawing, pitting, distortion, concentricity, and any abnormal condition.					X	Also to be performed one time at 5 years on sampling basis consistent with Component 340A/B.

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		2. Visually inspect subcovers for evidence of valve guide blowby (soot).						This is a one-time-only inspection, to be performed after 500 or 600 hours of operation after rebuild of a cylinder head.
		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 2 & 3). Also to be performed one time at 5 years on sampling basis consistent with Component 340A/B.
		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 cylinder. Use TDI SIM 336, Rev. 1 for clearance values (acceptance criteria). Also to be performed one time at 5 years on sampling basis consistent with Component 340A/B.
02-362A	Cylinder Head Covers - Subcover Assembly	1. Perform a liquid penetrant examination of the rocker arm pedestals top and vertical machined surfaces (connector push-rod side only).					X	Also to be performed one time at 5 years on a sampling basis consistent with Component 340A/B. Subcovers with pedestal cracks that extend through the counter bore web down to the threads should be replaced. Refr: DR/QR Report #02-362A.

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02-365A	Fuel Injection Pumps	1. Tear down one pump for inspection.			X			Use representative pump to determine need to overhaul other pumps. Complete fuel injection pump inspection in accordance with TDI Instruction and Maintenance Manual, Volume 1, Section 6. Based on inspection results and operating parameters. Complete TDI Instruction and Maintenance Record Form No. 365-1-1 as applicable, for the pump disassembled.
		2. Visually check pressure bleed screw for erosion on disassembled pump.			X			
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. Perform retorque requirement per TDI. Complete TDI Inspection and Maintenance Record Form 365-2-1 as applicable, Instruction Manual, Volume I, Section 6. Note: 135° fuel oil tips may be used if inspection results indicate a need for additional action to improve lubrication and reduce coke buildup.
		2. Check nozzle pop pressure.			X			
		3. Check spray pattern.			X			

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02-365D	Fuel Oil Injection Lines: Supports	1. Visually inspect support elastomer inserts for deterioration or degradation.		X				Any inserts found to be unsatisfactory shall be replaced with new inserts prior to reassembly of fuel oil lines. This inspection can be performed prior to reassembly of the fuel oil lines in conjunction with the cylinder liner inspection.
02-371A	Fuel Pump Control Shaft	1. Check and lubricate as required.						
02-371B	Fuel Pump Linkage Assembly and Bearings	1. Grease swivel link or otherwise lubricate all fuel oil pump assemblies.		X				
02-380A	Exhaust Manifold	1. Perform a visual examination of accessible pipe welds and corresponding heat-affected zones.			X			To be performed at EOC1 and alternate EOCs thereafter.
02-385A	Crankcase Relief Valve	1. Clean flame arrestors.			X			
		2. Inspect seat and disc.			X			
02-387A	Crankcase Vacuum Fan	1. Inspect fan and clean as necessary.			X			
		2. Check bearing for roughness.			X			
02-390E	Rocker Arm Bushings	1. Visually inspect and measure intake rocker arm bushings.					X	Also to be performed one time at 5 years on sampling basis consistent with Component 340A/B.
		2. Visually inspect and measure exhaust rocker arm bushings.					X	Also to be performed one time at 5 years on sampling basis consistent with Component 340A/B.
		3. Visually inspect and measure intermediate rocker arm bushings.					X	Also to be performed one time at 5 years on sampling basis consistent with Component 340A/B.

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02-390F	Hydraulic Valve Lifters	<ol style="list-style-type: none"> 1. Check and adjust valve lash. 2. Reinstall and adjust lifters. 			X			<p>X Also to be performed one time at EOC2 and at 5 years on a sampling basis consistent with Component 340A/B.</p> <p>Note: Ensure lifters are installed with the fill holes up. Verify condition of lifters by comparison of lifter leak-down rate (actual) to specifications noted on TDI Maintenance Manual. Refr: TDI Maintenance Manual, Section 6-B-5.</p>
02-410A	Overspeed Trip Governor	<ol style="list-style-type: none"> 1. Check trip set point - adjust as required. 				X		<p>Modify the surveillance testing procedure to include verification that the overspeed trip is correctly set to an overspeed trip setting of 517 ± 5 rpm. Ensure that the electric governor setting is properly returned to 450 rpm and the mechanical backup governor returned to the manufacturer's specified interval 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 should be reviewed to evaluate and possibly modify the testing interval. Also perform at EOC2.</p>

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								Note: After setting the overspeed governor, the adjustment screw settings should be marked with Torque Seal or other positive means 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			
		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 in compliance with SIM 363.						To be completed by the first refueling outage.
		2. Verify that coupling is tight on shaft.			X			
		3. Replace the Lovejoy coupling spiders or test coupling elastomer for hardness.			X			Replace elastomer if hardness is greater than 90 Shore A.
02-410D	Overspeed Trip Vent Valve	1. Disassemble and replace "O" rings or replace valve.			X			
02-411A	Governor Drive - Governor and Tachometer Drive Gear and Shaft	1. Visually inspect drive gear and shaft for signs of wear.					X	Also inspect one time at EOC nearest 5 years. For engine with less than 750 hours, also inspect at EOC2.
02-411B (excluding San Onofre - See Site Specific for San Onofre)	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.

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		2. Replace the elastomeric insert in the Koppers coupling.			X			
02-413A	Governor Linkage	1. 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.
		2. Inspect for loose parts on the linkage assembly.	X					
02-413A	Governor Linkage (DSRVs only)	3. Lubricate cross shaft bearings as required.						
		4. Grease the rod end fittings, or lubricate oil wicks, 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 when placing unit in maintenance modes.
		2. Check tailrod vent for air leakage.			X			To be accomplished during controls system check.
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. If contaminated oil is noted, increase frequency.				X		Note: Ensure the hydraulic actuator is properly vented.
		2. Disassemble, clean, and refurbish the actuator.					X	
		3. Verify all governor control knob settings are in appropriate positions.	X					Note: Mechanical governor setting to be 470 rpm.

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		4. Evaluate electric governor settings to verify overshoot of the 450 rpm set speed is within plant-specific guidelines and to avoid critical speeds during start or when unloaded.			X			An evaluation of the governor settings is to be performed during surveillance testing once under joint mechanical and electrical governor control.
02-415B	Governor Booster Servomotor	1. Clean, inspect, and replace "O" rings and gaskets.					X	
02-415C	Governor Heat Exchanger	1. Clean and inspect.					X	
02-435A	Jacket Water Fittings - Pipe and Fittings (Small Bore Scope Only)	1. Visually inspect for leaks.	X					
02-437	Turbo Water Piping-Pipe and Fittings	1. Visually inspect for leaks.	X					
02-441B	Air Filter to Starting Air Distributor	1. Replace filter elements. If filter in a metal screen, cleaning with solvent is acceptable in lieu of replacement.			X			This can be modified so that the filter is to be changed at a maximum pressure drop of 25 psi for engines equipped with pressure monitoring devices.
	Air Start Admission Valve Strainer	2. Clean and inspect strainer.			X			If the strainer is excessively dirty, the frequency of cleaning and inspecting should be increased.
	Air Start Block Valves	3. Clean and refurbish valves - replace "O" rings and clean the screened fitting. Ensure leak tightness after reassembly.					X	
		4. Inspect for tightness of fittings and bolts and apply locking compound as required during reassembly of components.						
		5. Replace "O" rings of the shuttle valve.					X	

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02-455A	Fuel Oil Filter	1. Record filter differential pressure.	X					Change filter elements when filter differential pressure reaches 20 psid rise above the clean differential pressure. Purge entrapped air from the filter canister using the vent valve provided, and divert some fuel oil into the newly replaced cartridge. After air has been purged, close vent valve and return handle to previous operating position.
		2. Inspect canister gaskets and replace as required.						To be performed during change out of filter elements.
		3. Inspect tubing and mechanical connections for tightness and/or leaks.	X					Refr: TDI Instruction Manual, Volume I.
02-455B	Fuel Oil Strainers	1. Record strainer differential pressure or monitor supervisory alarm as applicable.		X				If greater than 5 psid-shift, clean element. Bolt torques of 120-150 in-lbs should be utilized during reassembly.
		2. Purge air from stand-by strainers.						As required.
02-467A	Turbocharger Lube Oil Fitting: Pipe, Tubing, Fittings, and Flexible Coupling (Small Bore Scope Only)	1. Visually inspect for leaks.		X				
02-475A,C	Turbocharger: Bracket Bolting and Gaskets	1. At each engine shutdown for the first three engine shutdowns of operation after turbo installation, these screws should be visually inspected to assure that no screw has loosened because of engine operating loads. If during these inspections none of the screws are found loosened or damaged, future						

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		<p>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 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.</p> <p>Note: To avoid damage to bracket to engine, and/or bracket to turbo, the proper torques as delineated above should be utilized for each respective bracket bolting application.</p>						
02-475B	Air Butterfly Valve	1. Lubricate valve shaft via grease fittings.			X			If oil cups are used, lubricate shaft monthly.
		2. Check valve disc for freedom of movement.			X			Check by visually observing valve/actuator operation. If oil cups are used, this should be completed monthly.
		3. Verify that associated locking devices (jam nuts and lock washers) are tight.			X			
02-500A	Engine Control Cabinet	1. Inspect interior of cabinet for cleanliness, and clean as required.			X			
		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			

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		5. Replace "O" rings, gaskets, and filter in pressure regulator as required.						
		6. Inspect filter surface for matter to determine if problems may exist downstream.			X			
		7. Monitor control system air pressure or supervisory alarm as applicable.	X					
02-500C	Circuit Breakers and Contact Blocks	1. Check all terminals - clean and tighten.			X			Accomplished during panel cleaning and inspection.
		2. Visually check wiring insulation for degradation.			X			Accomplished during panel cleaning and inspection.
		3. Trip check circuit breakers.						To be performed at appropriate site intervals for similar equipment.
02-500G	Control Panel Valves	1. Inspect control panel valves for leaks.			X			
		2. Replace or refurbish pneumatic logic board.					X	
02-500J	Control Panel Assembly: Relays	1. Inspect contacts and clean as required.			X			
		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			
		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 and Press Regulator	1. Replace control valve "O" rings and lube shaft.						As required.
		2. Replace press regulator elastomeric parts.						As required.
02-525C	Barring Device Air Filter	1. Replace filter element.						As required.
		2. Drain barring device air filter.						As required.
02-525D	Barring Device - Mounting Bracket/Supports	1. Replace old cotter pin with new cotter pin after each reassembly.						To be performed after each reassembly.
02-540A	Lube Oil Sump Tank	1. Check lubricating oil with a viscosimeter for fuel oil dilution. Send a sample of oil to laboratory for analysis.		X				Refr: TDI Instruction Manual, Volume 1, Maintenance Schedule, Items 1, 2.
		2. Drain lubricating oil system and clean sump tank. Refill with new oil. To be performed based on sample analysis.						Note: When replacing engine oil use HD 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 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. Do not mix lube oil brands or types. When changing lube oil replace the entire charge. Replace as required.

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		3. Visually inspect lube oil sump tank level switch floats. Check switch set points.						To be performed per appropriate site intervals for similar equipment.
		4. Perform a spectrochemical engine oil analysis to assist the bearing monitoring program. To further expand or 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. Particular attention shall be given to percent moisture content.	X					Note: Sample to be drawn upstream of lube oil filter. Items 1 and 4 can be performed using the same sample.
02-550	Foundation Bolts	1. Visually inspect foundation for breaks in the bond between the sole plates and grout.			X			
		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-lbs, no retorque is required.						
02-630D	Thermocouples	1. Check that thermocouple indicates ambient engine temperature when the engine is cold.			X			An inconsistent reading traced to thermocouple trouble should result in replacement of the thermocouple.

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		2. Clean and inspect thermocouples and thermocouple shields as required.						Indications of fatigue should result in replacement of the thermocouple and/or thermocouple shield.
		3. Pyrometer wiring - check that terminations are tight.						To be accomplished during control panel check-out and initial operation inspections.
02-695B	Engine Control Air Pressure Regulator	1. Inspect and clean engine control air pressure regulator when pressure gauge indicates abnormal pressure reduction during normal engine shutdown.						Note: This recommendation should be reassessed depending on the degree of system fouling.
		2. Replace elastomeric parts and gaskets in the pressure regulator.						As required.
02-695C	Engine Control Pneumatic Trip Switches	1. Check switch set points per appropriate site interval.						Pressure switches and temperature switches.
		2. Replace elastomeric parts.						As required.
02-700B	Jacket Water Standpipe: Valves	1. Replace elastomeric parts in valves.						As required.
02-700F	Jacket Water Standpipe and Miscellaneous Bolting	1. Visually check 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 cracked nozzle welds.
		2. Check treatment (ph, etc. as applicable) of jacket water and correct as recommended by chemical supplier.					X	Also to be performed after adding makeup water.
02-717B	Auxiliary Sub-Base and Oil & Water Piping - Jacket Water: Valves	1. Inspect the valves for packing leakage.					X	Replace packing as necessary.

GENERIC MAINTENANCE MATRIX - PHASE II

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
02-717C	Auxiliary Sub-Base and Oil & Water Piping - Jacket Water: Pipe, Couplings, Fittings Orifices, Y-Strainers (Small Bore Scope Only)	1. Visually inspect for leaks.	X					
02-717F	Auxiliary Sub-Base Lube Oil Pipe and Fittings	1. Visually inspect pipe and joints for leakage. 2. Clean and inspect lube oil keep-warm pump suction strainer as required.	X					Complete when lube oil tank is drained.
02-717G/K	Auxiliary Sub-Base Lube Oil/ Fuel Oil Valves	1. Disassemble, inspect, and refurbish off engine lube oil and fuel oil valves as required. 2. Check relief valve lift pressure. Disassemble and clean if necessary.					X	
02-805B	Intake Air Filters	1. Inspect air intake/oil bath filters every 3 to 6 months.						Replace with change oil if necessary. If sampling is utilized, change based on analysis results.
02-805D	Flex Connection (Exhaust)	1. Visually inspect for evidence of cuts, holes, or dents. 2. Visually check for evidence of exhaust leakage.					X	
02-810C	Jacket Water Heat Exchanger	1. To avoid corrosion and fouling, 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.						

GENERIC MAINTENANCE MATRIX - PHASE II

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		2. Record heat exchanger parameters.	X					Use for trend data.
		3. Evaluate heat exchanger performance data.		X				
		4. Inspect tubes and tube sheet for fouling and erosion - remove entrance and exit channel covers as required by trend data or at overhaul. Also review consistent with inspections of other plant heat exchangers utilizing similar water chemistry.					X	Refr: TDI Instruction Manual, Volume I, Maintenance Schedule.
		5. Inspect and clean lantern ring as required. Verify leak-off holes are not plugged.						Replace or rework lantern ring as necessary to ensure concentricity prior to reinstallation.
		6. Replace packing rings as required.						Replace packing when packing becomes hard or leakage at the packing is noted and cannot be stopped by tightening.
02-810D	Thermostatic Valves	1. Replace thermal power elements as required.						
		2. Visually inspect valve bonnet for evidence of leakage.	X					To be accomplished during monthly test run. Ensure that any replacement valves have cast steel valve bodies.
02-810E	Jacket Water Heaters	1. Check calibration and inspect thermostat.						To be performed at appropriate plant interval for similar equipment. Replace heater if degradation of insulation resistance is noted.

GENERIC MAINTENANCE MATRIX - PHASE II

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
02-820A	Lube Oil Sump Tank Heaters	<ol style="list-style-type: none"> 1. Inspect and clean heater elements as required by trend data. 2. Check calibration and inspect condition of thermostat. 						<p>Replace heater if degradation of insulation resistance is noted.</p> <p>To be performed at appropriate site intervals for similar equipment.</p>
02-820C	Lube Oil Keep-Warm Pump	<ol style="list-style-type: none"> 1. Check mechanical seal and piping connection for leakage. 2. Verify pump discharge pressure is within manufacturer's specification. 	X		X			Use for trend data.
02-820D	Lube Oil Keep-Warm Strainer	<ol style="list-style-type: none"> 1. Clean or replace strainer element when the differential pressure change at the lube oil keep-warm strainer is 20 psid or for those plants not having this capability, clean or replace when differential pressure of keep warm filter is 20 psid. 						
02-820E	Lube Oil Keep-Warm Filter	<ol style="list-style-type: none"> 1. Record filter differential pressure. 2. Change filter elements as required. 		X				<p>To be performed when the filter differential pressure reaches 20 psid. For sites not equipped with differential pressure gauge, inspect monthly and clean as necessary.</p>
02-820F	Full Flow Lube Oil Filters	<ol style="list-style-type: none"> 1. Record filter differential pressure. 2. Replace filter cartridges and perform a visual inspection to determine nature of the material caught in the filter. 		X				<p>Use for trend data. Refr: TOI Instruction Manual, Volume I, Maintenance Schedule.</p> <p>To be performed when the filter differential pressure reaches 20 psid.</p>

GENERIC MAINTENANCE MATRIX - PHASE II

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		3. Lube oil filter gauge - calibration check.						To be performed at appropriate site intervals for similar equipment.
02-820G	Lube Oil Heat Exchanger	1. Record heat exchanger parameters.	X					Use for trend data.
		2. Evaluate heat exchanger performance data.			X			
		3. Inspect tubes and tube sheet.					X	Refr: TDI Instruction Manual, Volume I, Maintenance Schedule.
		4. Inspect and clean lantern ring as required. Verify leak-off holes are not plugged.						Replace or rework lantern ring as necessary to ensure concentricity.
		5. Replace packing rings at the floating tube sheet during reassembly.						When packing becomes hard or leakage at the packing is noted and cannot be stopped by tightening.
02-820H	Full Pressure Lube Oil Strainer	1. Monitor differential pressure of strainer and/or filter.						Use for trend data.
		2. Clean or replace strainer element when the differential pressure change at the lube oil strainer is 20 psid. For those plants not having this capability, clean or replace when differential pressure of full pressure filter is 20 psid.						To be performed when the differential pressure across the strainer is 20 psid. Refr. TDI Instruction Manual, Volume I, Maintenance Schedule.
		3. Lube oil strainer pressure gauge - calibration check.						To be performed per appropriate site intervals for similar equipment.

GENERIC MAINTENANCE MATRIX - PHASE II

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>All. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
02-835B	Diesel Starting Air Compressors	1. Check oil pressure and oil level if compressor is so equipped.	X					
		2. Overall visual inspection.	X					
		3. Clean fins on intercoolers and aftercoolers.			X			
		4. Inspect intake filter element if equipped and replace as necessary.			X			
		5. Change compressor oil at each EOC, or if monthly sampling is performed change as required based on results.			X			
		6. Check belt tension.			X			
		7. Check pulley clamp bolts and set screws tight.			X			
		8. Inspect filter felts on unloader system.				X		
02-835I	Air Dryers and Moisture Traps	1. Inspect and service moisture traps.			X			
		2. Check proper operation of dryer.	X					Replace desiccant charge or refrigerant as required.
02-835J	Starting Air Storage Tank	1. Disassemble and clean the float trap if installed.			X			

GENERIC MAINTENANCE MATRIX - PHASE II

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		2. Starting air tank pressure gauges - calibration check.						To be performed per appropriate site intervals for similar equipment.
		3. Starting air tank pressure switches - calibration check.						To be performed per appropriate site intervals for similar equipment.
	Piping System (For items not previously covered)	1. Conduct a detailed visual and audible inspection of all fuel, air, oil, and water piping and valves for leakage.	X					Tighten, repair, or replace as required. Refr: TDI Instruction Manual, Volume I, Maintenance Schedule.

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APPENDIX-II
SITE SPECIFIC MAINTENANCE MATRIX

PART D

SITE-SPECIFIC MAINTENANCE MATRIX

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
02-310A (Comanche Peak)	Crankshaft	1. Measure and record crankshaft web deflections (hot and cold).		X				Complete TDI Inspection and Maintenance Record Form No. 310-1-1 as applicable, TDI Instruction Manual, Volume 1, Section 6. Refr: TDI Instruction Manual, Volume 1, Maintenance Schedule.
		2. Examine the fillets and oil holes of three main bearing journals (4,6,& 8) using LP. If indications are evident, a more thorough examination should be made using appropriate NDE methods.						Also to be performed once at 5 years. Refr: PNL-5600.
		3. Examine the fillets and oil holes in three of the crankpin journals (choose 3 from Nos. 3 through 8 inclusive) using LP. If indications are evident, a more thorough examination should be made using appropriate NDE methods.						Also to be performed once at 5 years. Refr: PNL-5600.
		4. Measure diameter of crankpin journals.					X	Complete TDI Inspection and Maintenance Record Form No. 310-3-1 as applicable, TDI Instruction Manual, Volume 1, Section 6. Also perform inspection at 5 years, on items accessible, consistent with this component and Component 02-340A/B.

SITE-SPECIFIC MAINTENANCE MATRIX

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		5. Analyze the trends of cylinder pressure and temperature measurements to detect imbalances.			X			If an engine operates in a severely unbalanced condition, reinspect the oil holes for fatigue cracks within a time-frame determined by the utility considering the particular circumstances of the abnormal operation. Refr: PNL-5600.
		<p>Note: To avoid the effects of the 4th order resonance, steady normal-loaded operation at speeds more than a few rpm below the rated speed of 450 rpm should be avoided. Appropriate precautions should be taken to prevent sustained engine operation with significant cylinder imbalance. Lower speeds for testing and break-in are permissible. Avoid resonance frequencies.</p>						
								Refr: PNL-5600.

SITE-SPECIFIC MAINTENANCE MATRIX

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
02-315A (Comanche Peak)	Cylinder Block	<ol style="list-style-type: none"> 1. Perform a visual inspection of the block top under intense light to detect any obvious evidence of cracking. Areas between adjacent cylinder heads should be included in this inspection. 2. For blocks with known or assumed ligament cracks, perform a visual and boroscopic inspection of block tops for stud-to-stud cracks between cylinder heads and the block edge and the block edge and studs at the block ends. 3. Additional inspections to be performed per DR/QR Report 02-315A. 	X					<p>Perform monthly during surveillance run. Also perform during any period of continuous operation on a daily basis. Refr: DR/QR Report 02-315A.</p> <p>Also, this inspection must be performed after any period of operation exceeding 50% load. Refr: DR/QR 02-315A and/or subsequent inspections.</p> <p>To ensure engine availability after operation above 50% load, maintain the engine in standby service and perform the required surface inspection of the block top within 48 hours.</p>

TDI
OWNERS GROUP
APPENDIX-II

CROSS REFERENCE INDEX
BY COMPONENT

PART E

Legend

1. Index sorted by component name.
2. Component number listed or "nonum" indicates that the utility engine should perform the maintenance as described.
3. Blank indicates that utility is not required to perform maintenance indicated.
4. Maintenance or surveillance requirements for a subcomponent should be disregarded for those engines not equipped with the subcomponent.

TDI COMPONENT NUMBER CROSS REFERENCE

<u>COMPONENT DESCRIPTION</u>	<u>COMANCHE PEAK/ SHOREHAM</u>	<u>RANCHO SECO/ SAN ONOFRE</u>	<u>PERRY/ VOGTLE</u>	<u>RIVER BEND/ GRAND GULF</u>	<u>CATAWBA/ BELLEFONTE</u>	<u>WNP-1/ SHEARON HARRIS</u>
Air Butterfly Valve	02-475B/ 03-475B	03-475B/ 02-475B	02-475B/ 02-475B	03-475B/ 02-475B	02-475B/ 02-475B	02-475B/ 02-475B
Air Dryers and Moisture Traps	02-835I/ 03-835H	03-835H/ 02-835F	02-835A/ 02-835G	03-835I/ GG-115	02-835A/ 02-835C	02-835G/ 02-835C
Air Filter to Starting Air Distributor	02-441B/ 03-441B	03-441B/ 02-441B	02-441B/ 02-441B	03-441B/ 02-441B	02-441B/ 02-441B	02-441B/ 02-441B
Air Start Block Valves	NONUM/ 03-441B	NONUM/ NONUM	NONUM/ NONUM	NONUM/ NONUM	NONUM/ NONUM	NONUM/ NONUM
Air Start Valves	02-359/ 03-359	03-359/ 02-359	02-359/ 02-359	03-359/ 02-359	02-359/ 02-359	02-359/ 02-359
Auxiliary Sub-Base & Oil & Water Piping - Jacket Water: Pipe, Couplings, Fittings, Orifices, Y-Strainers (Small Bore Scope Only)	02-717C/ 03-717C	03-717D/ 02-717C	02-717C/ 02-717C	03-717D/ 02-717C	____/ ____/	02-717C/ 02-717D
Auxiliary Sub-Base & Oil & Water Piping - Jacket Water: Valves	02-717B/ 03-717B	03-717B/ 02-717B	02-717B/ 02-717B	03-717B/ 02-717B	02-717B/ 02-717B	02-717B/ 02-717B
Auxiliary Sub-Base Lube Oil Pipe and Fittings	02-717F/ 03-717H	03-717H/ 02-717F	02-717F/ 02-717F	03-717H/ 02-717F	NONUM/ 02-717F	02-717F/ 02-717H
Auxiliary Sub-Base Lube Oil/ Fuel Oil Valves	02-717G/K/ 03-717I/N	03-717I/N/ 02-717G/K	02-717G/K/ 02-717G	03-717H/N/ 02-717G/K	NONUM/ 02-717G/K	02-717G/K/ 02-717I

TDI COMPONENT NUMBER CROSS REFERENCE

<u>COMPONENT DESCRIPTION</u>	<u>COMANCHE PEAK/ SHOREHAM</u>	<u>RANCHO SECO/ SAN ONOFRE</u>	<u>PERRY/ VOGTLE</u>	<u>RIVER BEND/ GRAND GULF</u>	<u>CATAWBA/ BELLEFONTE</u>	<u>WNP-1/ SHEARON HARRIS</u>
Barring Device Air Filter	02-525C _____	03-525C _____	_____/	_____/	_____/	_____/
Barring Device Control Valve and Press Regulator	02-525B/ 03-525B	03-525B/ _____	02-525B/ _____	03-525B/ 02-525B	_____/	02-525B/
Base Assembly	02-305A/ 03-305A	03-305A/ 02-305A	02-305A/ 02-305A	03-305A/ 02-305A	02-305A/ 02-305A	02-305A/ 02-305A
Cam Gear	02-350C/ 03-350C	03-350C/ 02-350C	02-350C/ 02-350C	03-350C/ 02-350C	02-350C/ 02-350C	02-350C/ 02-350C
Camshaft Assembly	02-350A/ 03-350A	03-350A/ 02-350A	02-350A/ 02-350A	03-350A/ 02-350A	02-350A/ 02-350A	02-350A/ 02-350A
Camshaft Bearings	02-350B/ 03-350B	03-350B/ 02-350B	02-350B/ 02-350B	03-350B/ 02-350B	02-350B/ 02-350B	02-350B/ 02-350B
Circuit Breakers and Contact Blocks	02-500C/ 03-500C	03-500C/ 02-500C	02-500C/ 02-500C	03-500C/ 02-500C	02-500C/ 02-500C	02-500C/ 02-500C
Connecting Rods, Bushings and Bearing Shells	02-340A/B/ 03-340A/B	03-340A/B/ 02-340A/B	02-340A/B/ 02-340A/B	03-340A/B/ 02-340A/B	02-340A/B/ 02-340A/B	02-340A/B/ 02-340A/B
Control Panel Assembly: Relays	02-500J/ 03-500J	03-500J/ 02-500J	02-500I/ 02-500J	03-500J/ 02-500J	02-500J/ 02-500J	02-500J/ 02-500J
Control Panel Switches Terminal Boards and Wiring	02-500N/ 03-500N	03-500N/ 02-500N	02-500M/ 02-500N	03-500N/ 02-500N	02-500N/ 02-500N	02-500N/ 02-500N

TDI COMPONENT NUMBER CROSS REFERENCE

<u>COMPONENT DESCRIPTION</u>	<u>COMANCHE PEAK/ SHOREHAM</u>	<u>RANCHO SECO/ SAN ONOFRE</u>	<u>PERRY/ VOGTLE</u>	<u>RIVER BEND/ GRAND GULF</u>	<u>CATAWBA/ BELLEFONTE</u>	<u>WNP-1/ SHEARON HARRIS</u>
Control Panel Valves	02-500G/ 03-500G	03-500G/ 02-500G	02-500G/ 02-500G	03-500G/ 02-500G	02-500G/ 02-500G	02-500G/ 02-500G
Crank to Lube Oil Pump Gear	02-355A/ 03-355A	03-355A/ 02-355A	02-355A/ 02-355A	03-355A/ 02-355A	02-355A/ 02-355A	02-355A/ 02-355A
Crankcase Assembly	02-311A/ _____	_____/_____ 02-311A	02-311A/ 02-311A	_____/_____ 02-311A	02-311A/ 02-311A	02-311A/ 02-311A
Crankcase Relief Valve (and covers)	02-385A/ 03-385A	03-385A/ 02-385A	02-385A/ 02-385A	03-385A/ 02-385A	02-385A/ 02-385A	02-385A/ 02-386A
Crankcase Vacuum Fan	02-387A/ _____	_____/_____ NONUM	_____/_____ _____	_____/_____ 02-387A	_____/_____ _____	_____/_____ _____
Crankshaft	02-310A/ 03-310A	03-310A/ 02-310A	02-310A/ 02-310A	03-310A/ 02-310A	02-310A/ 02-310A	02-310A/ 02-310A
Cylinder Block	02-315A/ 03-315A	03-315A/ 02-315A	02-315A/ 02-315A	03-315A/ 02-315A	02-315A/ 02-315A	02-315A/ 02-315A
Cylinder Head	02-360A/ 03-360A	03-360A/ 02-360A	02-360A/ 02-360A	03-360A/ 02-360A	02-360A/ 02-360A	02-360A/ 02-360A
Cylinder Head - Intake and Exhaust Valves	02-360B/ 03-360B	03-360B/ 02-360B	02-360B/ 02-360B	03-360B/ 02-360B	02-360B/ 02-360B	02-360B/ 02-360B
Cylinder Head Covers - Subcover Assembly	02-362A/ 03-362A	03-362A/ 02-362A	02-362A/ 02-362A	03-362A/ 02-362A	02-362A/ 02-362A	02-362A/ 02-362A

TDI COMPONENT NUMBER CROSS REFERENCE

<u>COMPONENT DESCRIPTION</u>	<u>COMANCHE PEAK/ SHOREHAM</u>	<u>RANCHO SECO/ SAN ONOFRE</u>	<u>PERRY/ VOGTLE</u>	<u>RIVER BEND/ GRAND GULF</u>	<u>CATAWBA/ BELLEFONTE</u>	<u>WNP-1/ SHEARON HARRIS</u>
Cylinder Liners	02-315C/ 03-315C	03-315C/ 02-315C	02-315C/ 02-315C	03-315C/ 02-315C	02-315C 02-315C	02-315C/ 02-315C
Diesel Starting Air Compressors	02-835B/ 10-112	03-835G/ 02-835A	02-835D/ 02-835A	03-835D/ GG-113/14	NONUM/ 02-835B	02-835B/ _____
Emergency Generator	CP-101A/ 03-650A	03-650A/ S0-101	_____/_____ 02-650A	03-650A/ GG-101A	CN-119/ BL-101A	84-101A/ 02-650A
Emergency Generator Control Panel	CP-102/ 03-650B	03-650B/ _____	_____/_____ 02-650B	03-650B/ GG-119	_____/_____ BL-101B	84-121/ 02-650B
Emergency Generator Pedestal Bearing (and shaft)	CP-101B/ 03-650C	03-650C/ S0-103	02-650C/ 02-650C	03-650C/ GG-101B	CN-119A BL-101C	84-101B/ 02-650C
Engine Control Air Pressure Regulator (Valves, Orifices)	02-695B/ 03-695B	03-695B/ 02-695B	02-695B/ 02-695B	03-695B/ 02-695B	02-695B/ 02-695B	02-695B/ 02-695B
Engine Control Cabinet	02-500A/ 03-500A	03-500A/ 02-500A	02-500A/ 02-500A	03-500A/ 02-500A	02-500A/ 02-500A	02-500A/ 02-500A
Engine Control Pneumatic Switches	02-695C/ 03-695C	03-695C 02-695C	02-695C/ 02-695C	03-695C/ 02-695C	02-695C/ 02-695C	02-695C/ 02-695C
Exhaust Manifold	02-380A/ 03-380A	03-380A/ 02-380A	02-380A/ 02-380A	03-380A/ 02-380A	02-380A/ 02-380A	02-380A/ 02-380A

TDI COMPONENT NUMBER CROSS REFERENCE

<u>COMPONENT DESCRIPTION</u>	<u>COMANCHE PEAK/ SHOREHAM</u>	<u>RANCHO SECO/ SAN ONOFRE</u>	<u>PERRY/ VOGTLE</u>	<u>RIVER BEND/ GRAND GULF</u>	<u>CATAWBA/ BELLEFONTE</u>	<u>WNP-1/ SHEARON HARRIS</u>
Flex Connection	02-805D/ 10-109	15-110/ 02-805C	02-805D/ 02-805D	03-805D/ GG-111	CN-121/ 02-805A	84-114/ 02-805D
Foundation Bolts	02-550/ 03-550	03-550/ 02-550	02-500/ 02-550	03-500/ 02-550	02-500/ 02-550	02-500/ 02-550
Fuel Injection Nozzles	02-365B/ 03-365B	03-365B/ 02-365B	02-365B/ 02-365B	03-365B/ 02-365B	02-365B/ 02-365B	02-365B/ 02-365B
Fuel Injection Pumps	02-365A/ 03-365A	03-365A/ 02-365A	02-365A/ 02-365A	03-365A/ 02-365A	02-365A/ 02-365A	02-365A/ 02-365A
Fuel Injection Tubing	02-365C/ 03-365C	03-365C/ 02-365C	02-365C/ 02-365C	03-365C/ 02-365C	02-365C/ 02-365C	02-365C/ 02-365C
Fuel Oil Filter	02-455A/ 03-455A	SC-014A 02-455A	02-455A/ 02-455A	03-455A/ 02-455A	02-455A/ 02-455A	02-455A/ 02-455A
Fuel Oil Injection Lines: Supports	02-365D/ 03-365D	03-365D/ 02-365D	02-365D/ 02-365D	03-365D/ 02-365D	02-365D/ 02-365D	02-365D/ 02-365D
Fuel Oil Strainers	02-455B/ 03-455B	SC-042B/ 02-455B	02-455B/ 02-455B	03-455B/ 02-455B	02-455B/ 02-455B	02-455B/ 02-455B
Fuel Pump Control Shaft	02-371A/ 03-371A	03-371A/ 02-371A	02-371A/ 02-371A	03-371A/ 02-371A	02-371A 02-371A	02-371A/ 02-371A

TDI COMPONENT NUMBER CROSS REFERENCE

<u>COMPONENT DESCRIPTION</u>	<u>COMANCHE PEAK/ SHOREHAM</u>	<u>RANCHO SECO/ SAN ONOFRE</u>	<u>PERRY/ VOGTLE</u>	<u>RIVER BEND/ GRAND GULF</u>	<u>CATAWBA/ BELLEFONTE</u>	<u>WNP-1/ SHEARON HARRIS</u>
Fuel Pump Linkage Assembly and Bearings	02-371B/ 03-371B	03-371B/ 02-371B	02-371B/ 02-371B	03-371B/ 02-371B	02/371B 02-371B	02-371B/ 02-371B
Fuel Pump Linkage: Automatic Shutdown Cylinder	02-413B/ 03-371C	03-371C/ 02-413B	02-413B/ 02-413B	03-371C/ 02-413B	02-413B/ 02-413B	02-413B/ 02-413B
Fuel Tappet Assembly	02-345B/ 03-345B	03-345B/ 02-345B	02-345B/ 02-345B	03-345B/ 02-345B	02-345B/ 02-345B	02-345B/ 02-345B
Full Flow Lube Oil Filter(s)	02-820F/ 10-106	03-820E/ 02-820C	02-820F/ 02-717S	03-820B/ GG-820B	CN-110/ 02-820D	84-115/ 02-820E
Full Pressure Lube Oil Strainer	02-820H 03-820C	03-820C/ SE-014	02-820C/ SE-025	03-460A/ SE-025	SE-025/ 02-820C	SE-025/ 02-820A
Flywheel Bolting	<u> </u> / 03-330B	<u> </u> / 02-330B	<u> </u> / _____	<u> </u> / _____	<u> </u> / _____	<u> </u> / _____
Gear Train	<u> </u> / _____	<u> </u> / NONUM	<u> </u> / _____	<u> </u> / _____	<u> </u> / _____	<u> </u> / _____
Governor Booster Servomotor	02-415B/ 03-415B	03-415B/ 02-415B	02-415B/ 02-415B	03-415B/ 02-415B	02-415B/ 02-415B	02-415B/ 02-415B
Governor Drive - Couplings, Pins and Keys	02-411B/ 03-402B	03-402B/ 02-411B	02-411B/ 02-411B	03-402B/ 02-411B	02-411B/ 02-411B	02-411B/ 02-411B
Governor Drive - Governor and Tachometer Drive Gear and Shaft	02-411A/ 03-402A	03-402A/ 02-411A	02-411A/ 02-411A	03-402A/ 02-411A	02-411A/ 02-411A	02-411A/ 02-411A

TDI COMPONENT NUMBER CROSS REFERENCE

<u>COMPONENT DESCRIPTION</u>	<u>COMANCHE PEAK/ SHOREHAM</u>	<u>RANCHO SECO/ SAN ONOFRE</u>	<u>PERRY/ VOGTLE</u>	<u>RIVER BEND/ GRAND GULF</u>	<u>CATAWBA/ BELLEFONTE</u>	<u>WNP-1/ SHEARON HARRIS</u>
Governor Heat Exchanger	02-415C/ 03-415C	03-415C/ NONUM	02-415C/ 02-415C	03-415C/ 02-415C	02-415C/ 02-415C	02-415C/ 02-415C
Governor Linkage	02-413A/ 03-413	03-413/ 02-413A	02-413A/ 02-413A	03-413/ 02-413A	02-413A/ 02-413A	02-413A/ 02-413A
Hydraulic Valve Lifters	02-390F/ 03-390F	_____/_____ 02-390F	02-390F/ _____	_____/_____ 02-390F	_____/_____ 02-390F	02-390F/ _____
Idler Gear Assembly	02-355B/ 03-355B	03-355B/ 02-355B	02-355B/ 02-355B	03-355B/ 02-355B	02-355B/ 02-355B	02-355B/ 02-355B
Intake Air Filters	02-805B/ 10-114	03-805B/ 02-805B	02-805B/ 02-805A	03-805B/ GG-118	CN-106/ 02-805C	84-111/ 02-805B
Intake and Exhaust Tappet Assembly	02-345A/ 03-345A	03-345A/ 02-345A	02-345A/ 02-345A	03-345A/ 02-345A	02-345A/ 02-345A	02-345A/ 02-345A
Intercoolers	F-068/ F-068	NB-002/ 41-127A	F-068/ F-068	F-068/ F-068	F-068/ F-068	F-068/ F-068
Jacket Water Fittings - Pipe and Fittings (Small Bore Scope Only)	02-435A/ 03-435A	03-435A/ 02-435A	02-435A/ 02-435A	03-435A/ _____	_____/_____ 02-435A	02-435A/ 02-435A
Jacket Water Heat Exchanger	02-810C/ 10-103	_____/_____ _____	02-810B/ 02-717Q	03-810A/ GG-103	CN-120/ 02-810A	02-717N/ 02-810C
Jacket Water Heaters	02-810E/ 03-800A	03-810C/ 02-810	02-810D/ 02-717N	03-800A/ 02-810A	CN-128/ 02-810D	02-810B/ 02-810A

TDI COMPONENT NUMBER CROSS REFERENCE

<u>COMPONENT DESCRIPTION</u>	<u>COMANCHE PEAK/ SHOREHAM</u>	<u>RANCHO SECO/ SAN ONOFRE</u>	<u>PERRY/ VOGTLE</u>	<u>RIVER BEND/ GRAND GULF</u>	<u>CATAWBA/ BELLEFONTE</u>	<u>WNP-1/ SHEARON HARRIS</u>
Jacket Water Pump - Gear	02-425A/ 03-425A	03-425A/ 02-425A	02-425A/ 02-425	03-425A/ 02-425A	02-425A/ 02-425A	02-425A/ 02-425A
Jacket Water Standpipe and Miscellaneous Bolting	02-700F/ _____	03-700F/ 02-700F	_____/ 02-700F	_____/ 00-700F	_____/ 02-700F	02-700E/ 02-700F
Jacket Water Standpipe: Valves	02-700B/ 00-700B	03-717B/ 02-700B	02-700B/ 02-700B	00-700B/ 00-700B	02-700B/ 02-700B	02-700B/ 02-700B
Lube Oil Heat Exchanger	02-820G/ 10-104	03-820D/ 02-820B	02-820G/ 02-717R	03-820A/ GG-104	CN-111/ 02-820A	02-717D/ 02-820B
Lube Oil Keep-Warm Filter	02-820E/ 10-117	03-820G/ 02-820E	02-820E/ 02-717V	03-820D/ GG-121	CN-122/ 02-820E	02-717S/ 02-820G
Lube Oil Keep-Warm Pump	02-820C/ 03-820C	03-820F/ 02-820D	02-820B/ 02-717U	03-820C/ GG-109	CN-109/ 02-820G	02-717R/ 02-820F
Lube Oil Keep-Warm Strainer	02-820D/ _____	03-820H/ _____	02-820D/ _____	_____/ _____	_____/ _____	02-717V/ 02-465D
Lube Oil Pressure Regulating Valve	00-420/ 00-420	00-420/ 00-420	00-420/ 00-420	00-420/ 00-420	00-420/ 00-420	00-420/ 00-420
Lube Oil Sump Tank Heaters	02-820A/ 03-800B	03-820B/ 02-820	02-820A/ 02-717P	03-800B/ 02-820A	02-540D/ _____	02-820A/ 02-820C
Lube Oil Sump Tank	02-540A/ 03-540A	03-540A/ 02-540A	02-540A/ 02-540A	03-540B/ 02-540A	02-540A/ 02-540A	02-540A/ 02-540A

TDI COMPONENT NUMBER CROSS REFERENCE

<u>COMPONENT DESCRIPTION</u>	<u>COMANCHE PEAK/ SHOREHAM</u>	<u>RANCHO SECO/ SAN ONOFRE</u>	<u>PERRY/ VOGTLE</u>	<u>RIVER BEND/ GRAND GULF</u>	<u>CATAWBA/ BELLEFONTE</u>	<u>WNP-1/ SHEARON HARRIS</u>
Lube Oil Tubing and Fittings - Internal	02-307B/ 03-307B	03-307B/ 02-307B	02-307B/ 02-307B	03-307B/ 02-307B	02-307B/ 02-307B	02-307B/ 02-307B
Main Bearing Caps - Studs and Nuts	02-305C/ 03-305C	03-305C/ 02-305C	02-305C/ 02-305C	03-305C/ 02-305C	02-305C/ 02-305C	02-305C/ 02-305C
Main Bearings Shells	02-310B/ 03-310B	03-310B/ 02-310B	02-310B/ 02-310B	03-310B/ 02-310B	02-310B/ 02-310B	02-310B/ 02-310B
Overspeed Trip Drive Couplings	02-410C/ 03-410C	03-410C/ 02-410C	02-410C/ 02-410C	03-410C/ 02-410C	02-410C/ 02-410C	02-410C/ 02-410C
Overspeed Trip Governor	02-410A/ 03-410A	03-410A/ 02-410A	02-410A/ 02-410A	03-410A/ 02-410A	02-410A/ 02-410A	02-410A/ 02-410A
Overspeed Trip Governor and Accessory Drive	02-410B/ 03-410B	03-410B/ 02-410B	02-410B/ 02-410B	03-410B/ 02-410B	02-410B/ 02-410B	02-410B/ 02-410B
Overspeed Trip Vent Valve	02-410D/ 03-410D	03-410D/ 02-410D	02-410D/ 02-410D	03-410D/ 02-410D	02-410D/ 02-410D	02-410D/ 02-410D
Piping System	NONUM/ NONUM	NONUM/ NONUM	NONUM/ NONUM	NONUM/ NONUM	NONUM/ NONUM	NONUM/ NONUM
Piston Pin Assembly	02-341C/ 03-341C	03-341C/ 02-341C	02-341C/ 02-341C	03-341C/ 02-340E	02-341C/ 02-341C	02-341C/ 02-341C
Piston Rings	02-341B/ 03-341B	03-341B/ 02-341B	02-341B/ 02-341B	03-341B/ 02-340D	02-340D/ 02-341B	02-341B/ 02-341B

TDI COMPONENT NUMBER CROSS REFERENCE

<u>COMPONENT DESCRIPTION</u>	<u>COMANCHE PEAK/ SHOREHAM</u>	<u>RANCHO SECO/ SAN ONOFRE</u>	<u>PERRY/ VOGTLE</u>	<u>RIVER BEND/ GRAND GULF</u>	<u>CATAWBA/ BELLEFONTE</u>	<u>WNP-1/ SHEARON HARRIS</u>
Pistons	02-341A/ 03-341A	03-341A/ 02-341A	02-341A/ 02-341A	03-341A/ 02-340C	02-340C/ 02-341A	02-341A/ 02-341A
Push Rods	02-390C/ 03-390C	03-390C/D/ 02-390C	02-390C/ 02-390C	03-390C/ 02-390C	02-390C/ 02-390C	02-390C/ 02-390C
Rocker Arm Bushings	02-390E/ 03-390E	03-390E/ 02-390E	02-390E/ 02-390E	03-390E/ 02-390E	02-390E/ 02-390E	02-390E/ 02-390E
Rocker Arm Capscrews, Drive Studs (Pop Rivets)	02-390G/ 03-390G	03-390G/ 02-390G	02-390G/ 02-390G	03-390G/ 02-360G	02-390G/ 02-390G	02-390G/ 02-390F
Starting Air Distributor Assembly	00-442A/ 03-442A	03-442A/ 02-442A	00-442A/ 02-442A	03-442A/ 02-442A	02-442A/ 00-442A	00-442A/ 02-442A
Starting Air Storage Tank	02-835J/ 10-111	03-835F/ 02-835E	02-835B/ 02-835D	03-835A/ _____	CN-112 02-835A	02-835F/ 02-835D
Thermocouples	02-630D/ 03-630D	03-630D/ 02-630D	02-630D/ 02-630D	03-630D/ 02-630D	02-630D 02-630D	02-630D/ 02-630D
Thermostatic Valves	02-810D/ 03-515	03-799A/ 02-515	02-810C/ 02-717W	03-515/ 02-515	C136/40/ 02-810C	02-810A/ 02-810E
Thrust Bearing Ring	02-310C/ 03-310C	03-310C/ 02-310C	02-310C/ 02-310C	03-310C/ 02-310C	02-310C/ 02-310C	02-310C/ 02-310C
Turbo/water Piping - Pipe and Fittings	02-437/ 03-437A	03-437A/ 02-437A	02-437/ 02-437A	03-437A/ 02-437	02-437/ 02-437	02-437/ 02-437

TDI COMPONENT NUMBER CROSS REFERENCE

<u>COMPONENT DESCRIPTION</u>	<u>COMANCHE PEAK/ SHOREHAM</u>	<u>RANCHO SECO/ SAN ONOFRE</u>	<u>PERRY/ VOGTLE</u>	<u>RIVER BEND/ GRAND GULF</u>	<u>CATAWBA/ BELLEFONTE</u>	<u>WNP-1/ SHEARON HARRIS</u>
Turbocharger	MP-022/23/ MP-017	MP-020/ MM-19/20	MP-022/3/ MP-022/3	MP-017/ MP-022/3	MP-022/3/ MP-022/3	MP-022/3/ MP-022/3
Turbocharger Lube Oil Fittings: Pipe, Tubing, Fittings and Flexible Coupling (Small Bore Scope Only)	02-467A/ 03-467A	03-467A/ 02-467A	02-467A/ 02-467A	03-467A/ 02-467A	02-467A/ 02-467A	02-467A/ 02-467A
Turbocharger: Bracket Bolting and Gaskets	02-475A,C/ 02-475A,D	03-475A,C/ 02-475A,C	02-475A,C/ 02-475A,C	02-475A,C/ 02-475A,C	02-475A,C/ 02-475A,C	02-475A,C/ 02-475A,C
Water Discharge Manifold - Jacket Water Discharge Piping, Couplings and Seals	02-317A&B/ 03-317A&B	03-317A&B/ 02-317A&B	02-317A&B/ 02-317A&B	03-317A&B/ 02-317A&B	02-317A&B/ 02-317A&B	02-317A&B/ 02-317A&B
Woodward Governor	02-415A/ 03-415A	03-415A/ 02-415A	02-415A/ 02-415A	03-415A/ 02-415A	02-415A/ 02-415A	02-415A/ 02-415A

TDI DIESEL GENERATOR
DESIGN REVIEW
AND QUALITY REVALIDATION
REPORT

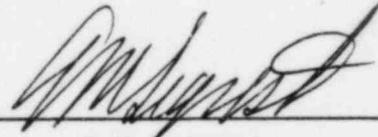
Prepared For

TEXAS UTILITIES GENERATING COMPANY
COMANCHE PEAK STEAM ELECTRIC STATION - UNIT 1

By

TDI DIESEL GENERATOR OWNERS GROUP

Revision 2
April 1986



A M Segrest
Program Manager
TDI Diesel Generator Owners Group

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APPENDIX - II
GENERIC MAINTENANCE MATRIX

TDI
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GENERIC MAINTENANCE MATRIX

APPENDIX - II

OVERVIEW AND DEFINITIONS

OPERATING AND STANDBY SURVEILLANCE
PARAMETERS

PART A

TDI OWNERS GROUP

GENERIC MAINTENANCE AND SURVEILLANCE PROGRAM

APPENDIX - II

I INTRODUCTION

The purpose of this appendix is to provide the TDI Owners 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 and including subsequent testing and inspections performed following the review conducted by the original program. This appendix is intended to enhance 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. The basis of this matrix is formed by the following:

- Owners Group Technical Staff review of TDI Instruction Manuals, SIMS, and TDI correspondence on specific components.
- Technical Staff input regarding the adequacy of recommendations found in sources mentioned above.
- Additional maintenance recommendations identified during the DR/QR review.
- Results of subsequent testing and surveillance (i.e., Shoreham EDG103 750-hour endurance run and subsequent engine teardown) performed following the review conducted during the original program.
- Additional review by the Owners Group representatives.

It should be noted that this revision in some cases modifies the original program results based on this additional information and review.

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. This schedule should be followed as closely as the operating conditions will permit. This maintenance service as specified supersedes previous general maintenance requirements, but is separate and does not supersede Quality Revalidation and/or modifications previously recommended. The schedule details specific components requiring maintenance on a regular basis. This schedule separates the maintenance activities into frequencies as set forth in the subsequent list of definitions.

Inspections, as outlined in this maintenance schedule, are to be performed and parts refurbished or replaced as required by the program or deemed necessary by the inspection. Any adverse findings shall be investigated and corrective action, including amended inspection frequencies, shall be implemented unless sufficient justification is present to do otherwise.

This generic matrix, Parts A, B, C together with Part D entitled "Site-Specific Maintenance Matrix" and the sources defined in Section II form the TDI Maintenance Program. Note that component numbers used in the generic matrix are for Texas Utilities' Comanche Peak Steam Electric Station - Unit 1. Part E provides a cross reference to identify corresponding components for other engines. Also note that a blank in the cross reference signifies that a component is not on a particular engine and thus that Owner would not perform that maintenance item.

Tables 1 and 2 of Part A provide engine operating and standby surveillance parameters and frequencies. It is recommended that the utility address these tables in its operating and monitoring programs. Table 1 addresses operating parameters and is not duplicated in the maintenance schedules; these parameters are to be recorded and/or checked during the monthly testing and any other period of operation. Table 2 addresses the standby parameters that occur on a daily frequency and are not duplicated in the maintenance schedules.

IV. DEFINITION OF TERMS

1. Overhaul Frequency

- a) A complete engine teardown and inspection will be performed every 10 years. The utility has the flexibility to inspect one engine/reactor unit at the EOC prior to 10 years and the other engine at the EOC following 10 years. Alternately for PWR units, the inspection may be performed coincident with the 10-year reactor vessel in-service inspection. This will permit both engines for each unit to be disassembled in parallel since one engine will not have to remain in service with the reactor vessel off loaded. (For reactor units having three engines, the inspections are to be carried out as above with the third engine to be inspected at the second EOC following 10 years). The 10-year interval will typically be taken from issuance of the Low Power Operating license or from subsequent teardown and inspection for plants already in operation.

- b) A one time inspection will be performed at the EOC closest to 5 years. For a unit, one engine may be inspected at the EOC prior to 5 years and the other at the EOC after 5 years to minimize plant outage length. (For reactor units having three engines, the inspections are to be carried out as above with the third engine to be inspected at the second EOC following 5 years). This inspection will generally involve the same components as the 10-year teardown; however, only a sample of items for some components will be inspected as set forth in the maintenance schedule. During this 5-year inspection any significant adverse findings of a particular component will result in an inspection of all such components of that engine to determine any adverse trends. Favorable findings will result in reassembly of the engine for service.
2. Daily Frequency - To be performed once per day.
 3. Monthly Frequency - To be performed once in a month; normally during, before, or after test run per plant Technical Specifications.
 4. EOC - (End of Cycle) - To be performed once during outage for refueling.
 5. Alternate EOC - To be performed once every other outage for refueling.
 6. Five Years - To be performed once at the EOC occurring nearest to the end of a recurring 5-year period.
 7. As Required - To be performed as often as good maintenance, site procedures, manufacturer's recommendations, or experience dictate as determined by site personnel.
 8. Maintenance - Monitoring and/or surveillance on a periodic frequency to assure the component will perform its intended function in a safe reliable manner.
 9. Accessible - Any item on which the required function can be performed without disassembly of an engine component. Removal of defined access cover is not considered disassembly.
 10. Appropriate NDE - Nondestructive examination selected by site personnel that is most suitable to obtain the information sought by an individual inspection item; choice of NDE shall be made to assure that the technique will detect indications consistent with the acceptance criteria.

TABLE 1

Diesel Engine Operating Surveillance Parameters and Frequency

<u>Component</u>	<u>Frequency</u>
1) Lube Oil Inlet Pressure to Engine	Log hourly
2) Lube Oil Filter Differential Pressure	Log hourly
3) Lube Oil Temperature (engine inlet and outlet)	Log hourly
4) Lube Oil Sump Level	Log hourly
5) Turbocharger Oil Pressure	Log hourly
6) Fuel Oil Filter Differential Pressure	Log hourly
7) Fuel Oil to Engine Pressure	Log hourly
8) Fuel Oil Day Tank Level	Check hourly
9) Jacket Water Pressure (engine inlet)	Log hourly
10) Jacket Water Temperature (in, out)	Log hourly
11) Engine Cylinder Temperature Exhaust - All (If temperature in any one cylinder exceeds 1050°, refer to MP-022/023 Item 7.)	Log hourly
12) Manifold Air Temperature (RB, LB for DSRV Engines)	Log hourly
13) Manifold Air Pressure (RB, LB for DSRV Engines)	Log hourly
14) Starting Air Pressure (RB, LB for DSRV Engines)	Check hourly
15) Crankcase Vacuum	Log hourly
16) Engine Speed	Log hourly
17) Hour Meter	Log hourly

TABLE 1 (Cont'd)

Diesel Engine Operating Surveillance Parameters and Frequency

<u>Component</u>	<u>Frequency</u>
18) Kilowatt Load	Log hourly
19) Visual Inspection for Leaks, etc.	Check hourly

TABLE 2

Diesel Engine Standby Surveillance Parameters and Frequency

<u>Component</u>	<u>Frequency</u>
1) Lube Oil Temperature (in, out)	Log daily
2) Lube Oil Sump Level	Log daily
3) Check Operation of Lube Oil Keep-Warm Pump Motor	Daily
4) Monitor Lube Oil Keep-Warm Strainer and/or Filter Differential Pressure	Daily
5) Perform a visual inspection for leakage of the Lube Oil Heat Exchanger. Verify that no leakage through the leak-off ports of the lantern ring is present.	Daily
6) Fuel Oil Day Tank Level	Log daily
7) Jacket Water Temperature (in, out)	Log daily
8) Perform a visual inspection for leakage at packing for Jacket Water Heat Exchanger whenever the engine is in the emergency STANDBY mode. Verify that no leakage through the leak-off ports of the lantern ring is present.	Daily
9) Governor Oil Level	Daily
10) Verify proper oil level of generator pedestal bearing	Daily
11) Starting Air Pressure	Log daily
12) Drain air receiver float traps and/or drain Starting Air Storage Tank and monitor the quantity of moisture produced. If quantity of moisture is excessive, correct immediately.	Daily

TABLE 2 (Cont'd)

Diesel Engine Standby Surveillance Parameters and Frequency

<u>Component</u>	<u>Frequency</u>
13) Check Operation of Compressor Air Traps	Daily
14) Test Annunciators	Before Engine Operation
15) Check Alarm Clear	Before Engine Operation
16) Inspect for Leaks	Daily
17) Visually inspect intercooler for external leaks including intake manifold drain connection.	Daily

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APPENDIX - II
GENERIC MAINTENANCE MATRIX

PART B
PHASE I COMPONENTS

GENERIC MAINTENANCE MATRIX - PHASE I

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
MP-022/23	Turbocharger	1. Measure vibration and check with baseline data.		X				To be accomplished during 24-hour test run.
		2. Inspect impeller/diffuser and clean if necessary.					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.
		4. Perform visual and blue check inspections of the thrust bearing.					X	Note: Thrust bearing inspection should also be performed after experiencing each 40 non-prelubed (automatic) fast starts. In addition, a one time inspection should be completed after the first 100 engine starts.
		5. Disassemble, inspect, and refurbish.					X	Note: During reassembly ensure that capscrews are properly installed with the recommended torque. If QR inspection was performed prior to accumulating significant hours (i.e., the number of hours accumulated during plant preoperational testing, approximately 100 hours), the turbochargers should be reinspected at the next EOC.

GENERIC MAINTENANCE MATRIX - PHASE I

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		6. The nozzle ring components and inlet guide vanes should be visually inspected for missing parts or parts showing distress. If such conditions are noted, the entire ring assembly should be replaced.				X		Also perform a visual inspection on one turbo-charger per nuclear unit at each EOC. Note: Discontinue inspection with appropriate re-design.
		7. Monitor inlet temperature to ensure gas temperature does not exceed manufacturer's recommendation of 1200°F if exhaust temperature for any cylinder exceeds 1050°F (Refr: Table 1).						Monitoring may be performed using permanent in-line thermocouple, strap-on thermocouple, heat gun, or other suitable means that has been appropriately tested and calibrated per plant procedures. Note: Also perform monitoring any time the engine operates in an unbalanced condition.
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 further before the engine is allowed to return to service. The mating surfaces of the base and cap shall be thoroughly cleaned with solvent before any reassembly. Perform on EOC basis for 3 cycles, then overhaul provided there are satisfactory results. Note: 3 EOC inspections may be eliminated by performing a metal analysis to confirm consistent to class 40 grey iron requirements; performing analysis does not eliminate need for overhaul inspections.

GENERIC MAINTENANCE MATRIX - PHASE I

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
02-305C	Main Bearing Caps - Studs and Nuts	<p>1. The mating surfaces at the bearing cap/saddle interface should be inspected when disassembled to ensure the absence of surface imperfections that might prevent tight boltup.</p> <p>Note: Upon removal of bearing caps, clean mating surfaces with a solvent prior to reassembly of the caps to the base.</p>						
02-310A	Crankshaft	See site specific recommendations						
02-315A	Cylinder Block	See site specific recommendations						
02-315C	Cylinder Liners	<p>1. Perform a visual inspection of liners for progressive wear.</p>						To be performed for first 2 EOCs following piston removal; then discontinue until next piston removal. Boroscopic inspection is acceptable if heads are not removed. Complete TDI Inspection and Maintenance Record Form No. 315-1-1 as applicable, TDI Instruction Manual, Volume I, Section 6.
02-340A/B	Connecting Rods, Bushings and Bearing Shells (Generic)	<p>1. Inspect and measure all connecting rod bearing shells to verify lube oil maintenance, which affects wear rate.</p>					X	Complete TDI Inspection and Maintenance Record Form No. 340-1-1 as applicable, TDI Instruction Manual, Volume I, Section 6, Appendix III for clearance values. Perform inspection at 5 years, on items accessible, consistent with Item 2 of this component.

GENERIC MAINTENANCE MATRIX - PHASE I

<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		2. Inspect and measure the connecting rods. Note: Perform inspection and measure four connecting rods for DSRVs and two for DSRs at random at one time 5-year inspection.					X	Complete TDI Inspection Maintenance Record Form No. 340-2-1, -2 as applicable, 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 as required.
		4. All connecting rod bolts, nuts, and washers should be visually inspected, and damaged parts should be replaced. The bolts should be MT inspected to verify the continued absence of cracking. No detectable cracks should be allowed at the root of the threads.					X	Perform inspection at 5 years, on items accessible, consistent with Item 2 of this component.
		5. During any disassembly that exposes the inside diameter of a rod-eye (piston pin) bushing, the surface of the bushing should be LP inspected to verify the continued absence of linear indications in the heavily-loaded zone width ± 15 degrees of the bottom dead-center position.						Perform inspection, as required and on items accessible, consistent with Item 2 of this component.
02-340 A/B DSRV's only	Connecting Rods, Bushings and Bearing Shells	6. Measure the clearance between the link pin and link rod. This clearance should be zero i.e., no measurable clearance when the specified bolt torque of 1,050 ft-lbs is applied.						To be performed once for each connecting rod.

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<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		7. At the overhaul, visually inspect the rack teeth surfaces for signs of fretting and at one time 5-year inspection for rods disassembled.					X	
		8. Inspect mating surfaces to verify that the minimum manufacturers' recommended percent contact surface is available.						To be performed once for new and/or replacement parts.
		9. If connecting rod bolt stretch was measured ultrasonically during reassembly following the preservice inspection, the lengths of the two pairs of bolts above the connecting rod should be remeasured ultrasonically before the link rod box is disassembled. If ultrasonic measurement was not previously used, begin use at next inspection that accesses the connecting rods. Measure bolt stretch before disassembly.					X	Also to be performed at any time the connecting rod is disassembled. Perform inspection at 5 years, on items accessible, consistent with Item 2 of this component.
		10. All connecting rod bolts should be visually inspected for thread damage (galling) and the two pairs of connecting rod bolts above the crankpin should be MT inspected to verify the absence of cracking. All washers used with the bolts should be examined visually for signs of galling or cracking and replaced if damaged.					X	Also to be performed at any time the connecting rod is disassembled. Perform inspection at 5 years, on items accessible, consistent with Item 2 of this component.
		11. A visual inspection should be performed of all external surfaces of the link rod box to verify the absence of any signs of service-included distress.					X	Also to be performed at any time the connecting rod is disassembled. Perform inspection at 5 years, on items accessible, consistent with Item 2 of this component.

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<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		12. All of the bolt holes in the link rod box should be inspected for thread damage (galling) or other signs of abnormalities. Bolt holes subject to the highest stresses (the pair immediately above the crankpin) should be examined with an appropriate non-destructive method to verify the absence of cracking. Any indications should be recorded for evaluation and corrective action.					X	Also to be performed at any time the connecting rod is disassembled. Perform inspection at 5 years, on items accessible, consistent with Item 2 of this component.
02-341A	Pistons	1. Inspect and measure skirt and piston pin. This item assumes that AE skirts are installed. For other types, see site-specific recommendations.					X	Complete TDI Inspection and Maintenance Report Form No. 341-1-1 as applicable, TDI Instruction Manual, Volume I, Section 6. Use Volume 1, Section 8, Appendix III for clearance values. To be performed at 5-year interval on sampling basis consistent with Component 02-340A/B-Connecting Rods.
02-360A	Cylinder Head	1. Visually inspect cylinder heads (all cylinders). Note: Inspection by boroscope is acceptable.					X	Complete TDI Inspection and Maintenance Record Form No. 360-1-1 as applicable, TDI Instruction Manual, Volume 1, Section 6 - one sheet for each head. To be performed at 5-year interval on sampling basis consistent with Component 02-340 A/B - Connecting Rods.
		2. Record cold compression pressures and maximum firing pressures.			X			If so indicated - remove cylinder heads, grind valves, and reseat. Refr: TDI Instruction Manual, Volume I, Section 6.

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<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
		3. Blow-over the engine at least 4 hours but not more than 8 hours after engine shutdown. The cylinder cocks should be open for detection of water leakage into the cylinders. A second air roll should be performed in the same manner approximately 24 hours after engine shutdown. In addition, the engine should be air rolled shortly before any planned start.						In the event water is detected, the cylinder head should be replaced or returned to the vendor for repair. Delete post-run air roll requirements for engines with Group III heads after one cycle with positive inspection results.
		4. Visually inspect the area around the fuel injection port on each cylinder head during the normal monthly run for signs of leakage.	X					If water leakage is detected, the head(s) should be replaced.
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.
		2. Visually inspect tubing lengths for fuel oil leaks or cracks if tubing is unshrouded. If shrouded, fuel oil leakage can be detected at the leak-off ports in the base nuts, which are provided for this purpose.		X				Fitting inspection for leaks to be performed at engine operation following shutdown. Subsequent inspections to be performed periodically as indicated. Unshrouded tubing, used as replacement, should be fully inspected consistent with FaAA NDE Procedure 11.10 prior to bending.

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<u>Component Number</u>	<u>Component Identification</u>	<u>PM Recommendation</u>	<u>Monthly</u>	<u>EOC</u>	<u>Alt. EOC</u>	<u>5 Year</u>	<u>Overhaul</u>	<u>Comments</u>
02-390G	Rocker Arm Capscrews, Drive Studs (Pop Rivets)	<ol style="list-style-type: none"> 1. Verify capscrew torque values during QR inspection. If not performed at QR, verify at next EOC, then as required at reassembly. 2. Verify that rocker arm drive studs are intact and tight during QR inspection or EOC1, then as required at reassembly. 						Use TDI Instruction Manual, Volume I, Section 8, Appendix IV for proper torque values.
02-425A	Jacket Water Pump - Gear	<ol style="list-style-type: none"> 1. Visually inspect jacket water pump gear for chipped or broken teeth, excessive wear, pitting or other abnormal conditions. 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. At next teardown, verify impeller is one piece, (i.e., without a bore insert). If it is not a one piece impeller, replace. 3. It is recommended that the castle nut that drives the external spline on its taper have minimum and maximum torque values of 120 ft-lbs and 660 ft-lbs respectively for DSRVs and a maximum torque value of 77 ft-lbs for DSRs. 				X	X	<p>Any abnormal situations or indications of progressive pitting should be reported for an engineering evaluation. For engines with less than 750 hours, also inspect by EOC2.</p> <p>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.</p>