



**NPG Design  
Criteria Document**

**TITLE  
TRAVELING WATER SCREENS AND  
TRASHRACKS**

**WB-DC-20-20  
Rev. 0009  
Page 1 of 22**

Quality Related ☒ Yes ☐ No

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Date

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### Revision Log

<b>Revision or Change Number</b>	<b>Effective Date</b>	<b>Affected Page Numbers</b>	<b>Description of Revision/Change</b>
0	2/2/73		Initial Issue.
1	8/24/73		Details not available.
2	6/29/79		Revised the following sections to reflect the revised flood levels, elevations, and nomenclature as outlined in design input memorandum on design criteria for flood protection provisions, WB-DC-40-29-2; 2.2, 3.1.4, 3.2.2, 4.1, 4.4.1, and 4.4.2.
3	2/5/86		Added SubSection 4.7 per design input memorandum WB-DC-20-20-1.
4	7/18/88		<p>This revision substantially revises and reformats the entire document. Commitments and requirements through May 16, 1986, are also incorporated in this revision. WB-DC-20-27, "ERCW Intake Pumping Station Trashracks" has been consolidated within this document, WB-DC-20-20. Information regarding the screen wash pumps and piping has been incorporated into this document. The title of WB-DC-20-20 was changed to reflect addition to the trashracks.</p> <ol style="list-style-type: none"> <li>1. A Table of Contents was added.</li> <li>2. An Abbreviations and Acronyms section was added.</li> <li>3. Section 1.0 was expanded to include the Trashracks and Screen wash Pumps.</li> <li>4. Section 2.1 was completely revised.</li> <li>5. Section 2.2 was completely revised.</li> <li>6. Section 2.3 is a new section.</li> <li>7. Section 2.4 is a new section replacing old Section 4.4.4 and adding requirements for the screen wash pumps.</li> <li>8. Section 2.5 is a new section replacing old Section 4.5 and adding requirements for the screen wash pumps.</li> </ol>

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4 (cont'd)			<p>9. Section 2.6 is a new section replacing old Sections 4.4.2, 4.4.3, and 4.6. Trashrack requirements were also added.</p> <p>10. Section 2.7 is a new section.</p> <p>11. Section 2.8 is a new section.</p> <p>12. Section 2.9 is a new section which replaces old Sections 4.1 and 4.2.</p> <p>13. Section 3.0 is completely revised.</p> <p>14. Section 4.0 is completely revised.</p> <p>15. Section 5.0 is a new section.</p> <p>16. Section 6.0 replaces old Section 5.0 and is substantially revised to incorporate additional reference documents and calculations.</p> <p>17. Section 7.0 is Appendix A which is the same as old Section 4.1.</p> <p>18. Added Table 7.2.</p>
DCN S-13288-A	10/5/90		<p>DCN RIMS NO. B26 900926 873</p> <p>Revised per CAQR WBP900155 Rev. 1 (pages iii and 4).</p>
5	10/25/92		<p>General Revision.</p> <p>Incorporated DIM-WB-DC-20-20-5 DIM-WB-DC-20-20-4 DIM-WB-DC-20-20-3 DIM-WB-DC-20-20-2</p> <p>The Corrective Action pertaining to this DC is incorporated in this revision from the following: WBE890178901SCA item 1G WBA890379923 - miscellaneous discrepancies WBFIR920001 - incorporate DIMS</p>
DCN S-23891-A	3/25/93		<p>DCN RIMS NO. T56 930326 954</p> <p>Revised to add Reference, O B E criteria, minor corrections. The revised portions of the document are identified by vertical lines.</p> <p>Pages changed: iii, vii, 2,3,4,7,8,9,10,11,12</p>

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DCN S-28161-A	12/10/93		DCN RIMS Number T56 931216 997  Revised Design Criteria to add Source Notes 1 and 2.  Revised pages: vi, 2, 4, and 10. Added pages: iii(a) Deleted pages: None Total pages: 21
DCN S-32575-A	10/7/94		DCN RIMS Number T56 941008 900  Modified Design Criteria to revise references by correcting transposed numbers and adding a RIMS number.  Pages Added: None Pages Deleted: None Pages Revised: iii(a), 4 and 10 Total Pages: 21 (including i-vii, iia)
6	11/15/99		DCN E-50010-A (T56 981102 801) revised Table 7.1 to reflect reanalysis of flood events.  Incorporates DCNs S-23891-A, S-28161-A, S-32575-A, and E-50010-A.  Deleted Coordination Log, which is not required per NEDP-10.  Renumbered entire document, which changed page number on the Table of Contents (pages iv-v), and made minor format changes.  Pages Revised: All Total Pages: 17 (includes pages i-v and 1-12)
7	6-14-2004		Incorporates EDC as follows:  EDC 51673-A revised Section 2.6 to add stainless steel screen information.  Total Pages: 17 (includes pages i-v and 1-12)

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<b>Revision or Change Number</b>	<b>Effective Date</b>	<b>Affected Page Numbers</b>	<b>Description of Revision/Change</b>
8	8-27-2008		<p>This DCD has been reviewed and determined to be fully applicable to both Unit 1 and Unit 2.</p> <p>Outstanding WITEL punchlist items are listed below:</p> <ul style="list-style-type: none"> <li>--PL-08-1104, see Sections 2.1.2 and 6.1.1</li> <li>--PL-08-1105, see Sections 2.4 and 6.1.2</li> <li>--PL-08-1106, see Sections 2.4 and 6.1.3</li> <li>--PL-08-1107, see Section 6.1.4</li> <li>--PL-08-1109, see Sections 2.4 and 6.4.1</li> <li>--PL-08-1110, see Section 6.4.2</li> <li>--PL-08-1111, see Sections 2.10 and 6.4.3</li> <li>--PL-08-1112, see Sections 2.10 and 6.4.4</li> <li>--PL-08-1113, see Sections 2.10 and 6.4.5</li> <li>--PL-08-1114, see Sections 2.3 and 6.4.7</li> <li>--PL-08-1115, see Sections 2.3 and 6.4.8</li> <li>--PL-08-1125, see Sections 2.2.1 and 6.4.9</li> </ul> <p>The following editorial changes are performed:</p> <ol style="list-style-type: none"> <li>1) Change Reference 6.3.3 from AISC Steel Construction Manual, 7<sup>th</sup> Edition, to "Specification for Design, Fabrication, and Erection of Structural Steel for Buildings," American Institute of Steel Construction (AISC), 7<sup>th</sup> Edition with Supplements and/or 8<sup>th</sup> Edition." in accordance with PER 143262 C/A.</li> <li>2) Section 2.1.2 to correct Table No. from 7.2.1 to 7.2 with the 1 changed to a superscript to indicate a Source Note.</li> </ol> <p>Pages Revised: Coversheet, iv, v, 2, 3, 4, 6, 7, 8, 9 Total Pages: 18 (includes pages i-vi and 1-12)</p>
9	12-12-2008	All	<p>This Design Criteria has been converted from Word 95 to Word 2003 template using Rev. 8.</p> <p>The following change was made for corrective action 145221-001.</p> <p>Revision 8 states that compressed air supply to the water screen bubblers is "Service Air." DCN 50987 changed the compressed air supply to "Control Air."</p> <p>The following sentences were inserted into the second paragraph of Section 2.4 before the sentence "To resolve this issue..."</p>

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9 (cont'd)			<p>“DCN 50987 was issued to change the compressed air supply from Service Air to Control Air due to a leak in the buried Service Air line to the IPS. Control Air is a non-qualified System.”</p> <p>The SAR and Technical Specifications have been reviewed and are not affected by this revision.</p>

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## **1.0 SCOPE**

These criteria establish the function and design requirements for the screen wash system, trashracks, and traveling water screens at the intake pumping station (IPS).

The trashracks prevent large debris from interfering with the operation of the traveling water screens under any operating condition. The traveling water screens remove debris from the reservoir water that passes through the trashracks.

Four screens shall be provided at the IPS with two screens per ERCW pump well. Each screen shall have sufficient capacity to screen the amount of water required for one train. The capacity of one train is sufficient to supply all water required for essential raw cooling water (ERCW) during a design basis event (DBE).

## **2.0 DESIGN REQUIREMENTS**

### **2.1 FUNCTIONAL REQUIREMENTS**

#### **2.1.1 Normal Functions**

The trashracks shall be designed to prevent large objects from interfering with or damaging the traveling water screens.

The screen wash system shall be designed to operate with screen operation so as to minimize carryover of debris into the screened water.

The trashracks, traveling screens, and screen wash pumps shall support ERCW system operation during normal plant operation. However, for conditions of normal trash flow, the screens can function for extended periods without operation of the baskets and spray nozzles.

The traveling screens shall be designed to remove objects large enough (approximately 3/8-inch diameter and larger) to cause damage to pumps or to plug ERCW, RCW, and HPFP piping.

The screen motors and traveling screens shall be designed for continuous duty at a service factor of 1.0.

Debris collected by the traveling screens shall not be returned to the intake channel. The debris shall be transported to a holding pond where it will be stored prior to disposal.

#### **2.1.2 Safety Functions**

The system is required to mitigate the consequences of DBEs. The required DBEs and associated safety functions for the system are in WB-DC-40-64, (Ref 6.2.19).

As part of the ERCW system the screens must provide screening of the reservoir water during DBEs.

**Ref 6.1.1 [PL-08-1104] and 6.2.2 contain information on the remaining portions of the ERCW system.**

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## **2.1.2 Safety Functions (continued)**

Damage to three of the four screens is permissible as the capacity of one screen provides adequate flow for safe shutdown for both units. The traveling screens are seismic Category I equipment. Measures equivalent to TVA Class C shall be taken for the design, fabrication, and installation of the traveling screens. Although the screen wash pumps, piping and valves are required for plant safety, they were not purchased to TVA Class C standards. The pumps are qualified to Seismic Category I (ref 6.2.21), have limited QA, and were the best commercially available product for the service. The piping and valves are designed to TVA Class G and Seismic Category IL(A) for pressure boundary integrity. For this application this level of qualification meets the intent of TVA Class C. Future modifications or repair to the screen wash pumps, piping, or valves shall be made to the requirements of TVA Class C. The screen wash pumps and traveling water screens component parameters are in Table 7.2.<sup>1</sup>

## **2.2 DESIGN BASIS EVENTS**

### **2.2.1 Earthquakes**

The screens are Seismic Category I equipment and shall remain intact during and after a safe shutdown earthquake (SSE) and shall be operable after the earthquake. It is not necessary for the screen baskets to travel during an earthquake. It is assumed that an OBE will not occur when water at the screens is above EI 713.0' (one-half maximum flood) and that a SSE will not occur when water at the screens is above EI 695.0' (25-year flood) (Ref 6.2.9).

The screen wash piping and pumps shall be qualified as Seismic Category 1L(A) to maintain pressure boundary integrity.

The traveling water screens, screen wash pumps, and associated piping shall be qualified to meet the requirements of Ref 6.2.1, 6.2.16, 6.2.17, and 6.2.18. See Section 2.7 for requirements applicable to system/component design classification. For details of the IPS structure design criteria, see Ref 6.2.3.

**Seismic loads between the trashracks and IPS structure shall not be considered since the trashracks will not be rigidly fastened to the structure but have some clearance to move independently (Ref 6.4.9). [PL-08-1125]**

### **2.2.2 Tornadoes and Wind**

The traveling screens and screen wash pumps are to remain intact and be operable during and after tornadoes. The portion of the screens below deck is protected by the IPS which is a Category I structure. The portion of the screens above deck shall be protected by vertical concrete walls and a steel grillage roof. A vertical concrete wall separates the screens for the two water supply trains so that a missile blown downward would affect the screens for only one loop. Ref 6.2.10 contains information on the types of missiles to be considered.

### **2.2.3 Floods**

Drive machinery for the screens and screen wash pumps shall be located on the EI 741.0' deck which is above the design base flood within the IPS and wave runup on the outside walls. Flood levels are in Ref 6.2.9.

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## 2.3 ENVIRONMENTAL REQUIREMENTS

Components of the traveling screens, trashracks, screen wash pumps, and piping shall be designed for the environmental conditions given in WB-DC-40-42 (Ref 6.2.11) including wind, snow, and ice. It is assumed that an earthquake and tornado will not occur simultaneously. Design Criteria WB-DC-40-42 (Ref 6.2.11) and WB-DC-40-54 (Ref 6.2.12) shall be used for the design and procurement of new and replacement equipment.

Portions of the screens above deck level at El 741.0' shall be designed for loads produced by snow and ice. Piping which is required for screen operation shall be heat traced or self draining.

**Mechanical equipment/components requiring environmental qualification are listed in WBN-OSG4-016 (Ref 6.4.7) [PL-08-1114], and WBN-OSG4-098, (Ref 6.4.8) [PL-08-1115].**

## 2.4 INSTRUMENTATION AND CONTROL REQUIREMENTS

Instruments and controls required for the system are identified in Ref 6.2.2.

Instrumentation shall be provided to indicate differential water level (pressure) across each traveling water screen both locally and in the main control room (MCR). A high differential water level MCR alarm shall also be provided to indicate possible clogging of the screens, impending structural damage or a loss of signal, and a high differential water level for the screen wash pump automatic start function. This instrument uses a bubbler whereby compressed air is dispersed near the bottom of the screen well in parallel pipes on opposite sides of the screens to determine the differential level. CAQR WBP900155 determined that the bubbler does not meet single failure criteria because the air source is Service Air, a non-qualified system. DCN 50987 was issued to change the compressed air supply from Service Air to Control Air due to a leak in the buried Service Air line to the IPS. Control Air is a non-qualified system. To resolve this issue, it is now required that the screen wash system be in continuous operation within three hours following a loss of upstream or downstream dam. The bubbler will continue to operate as designed, except it is not relied on for a safety function.

Local instruments shall be provided to indicate screenwash pump discharge pressure. Strainer dp will initiate automatic strainer backwash when required.

**Controls for each screen shall include a local station and a pressure interlock with the screen wash pumps (Ref 6.1.2 [PL-08-1105] and 6.1.3 [PL-08-1106]). The local station shall provide for testing of the screens. A dp switch shall automatically start the screenwash pump for a screen when any ERCW pump in the water supply train is operating and the head loss across the screen exceeds the setpoint (Ref 6.4.1). [PL-08-1109]**

**When screen wash pump (SWP) discharge pressure reaches the setpoint (Ref 6.4.1) [PL-08-1109], the screen will start.** Each screen shall have a separate screen wash pump. Starting of the screens by pressure switches on the spray water discharge lines assures adequate spray for removal of trash when the screens are started. This greatly reduces the possibility of trash carry over into the screened water. Screen wash pump controls shall be Class 1E and designed per WB-DC-30-27 (Ref 6.2.5).

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## **2.4 INSTRUMENTATION AND CONTROL REQUIREMENTS (continued)**

**The speed detection system for each screen shall give a local indication and alarm in Main Control Room when motor speed is below 1600 rpm and when the motor speed exceeds normal speed by 10-20 rpm. (Reference 6.4.1) [PL-08-1109]**

Controls for the screens shall provide for operation of the screens during floods, during post-tornado periods, and during post-earthquake periods. Timers shall be provided for the screens to operate the screens for 15-20 minutes every 60 hours to prevent seizing of machinery parts from non-use. Seismic qualifications, separation, redundancy, and other requirements for control panels are in Ref 6.2.6 and 6.2.20.

## **2.5 ELECTRICAL POWER REQUIREMENTS**

Class 1E, 480V, 3-phase, 60 HZ, ac electrical power per WB-DC-30-28 (Ref 6.2.8) shall be supplied to the safety-related portions of the traveling water screens and screen wash pumps.<sup>2</sup> The Class 1E power shall be of the same train as the associated ERCW loop. The non-safety-related portions shall receive non-trained electrical power as required. Screen drive and screen wash pump motors shall be Class 1E, totally enclosed and suitable for outdoor service.

Electrical components essential to screen operation shall be Class 1E.

Instrumentation and control power shall be per WB-DC-30-27 (Ref 6.2.5).

## **2.6 MECHANICAL REQUIREMENTS**

The screens are the flow-through, self-cleaning type. Screen wash pump and traveling screen parameters are in Table 7.2. Baskets for the screens are provided with screen panels made of No. 12 W&M gauge hot-dip galvanized steel wire or #14 gage (W&M) 304 SS. Removal of debris from the basket screens is accomplished by water sprays located in the headframe. Screen drive components shall be designed to withstand an oil and moisture environment and the stall torque of the motor with stresses not exceeding 0.9 yield. The drive chain shall run in an oil bath if made of carbon steel. Drive components shall be suitable for outdoor service.

Joints in carrier chains shall be provided with lubrication fittings.

Welding shall be done per Ref 6.3.3 specifications as applicable. Connections among frame sections shall be made by corrosion-resistant bolts. Length of frame sections shall not exceed 2 feet.

For shielded metal arc welding, minimum weld size requirements from Table 1.17.5 of the AISC Specification (Ref 6.3.3) shall be met for new and modified fillet weld design but need not be considered for previously designed fillet welds provided applicable stress requirements were met.

Steel surfaces, except components of standard manufacture, wire for the baskets, and bearing surfaces shall be cleaned per SSPC-SP10-63T (Ref 6.3.2). After cleaning, cleaned surfaces shall be painted with two coats of epoxy coal tar and painted surfaces shall be touched up after erection.

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## **2.6 MECHANICAL REQUIREMENTS (continued)**

Trashracks shall be designed per the 1969 AISC specification (Ref 6.3.3). The traveling screens shall be designed per AWS D1.1-1972 (Ref 6.3.1).

Connections for the trashracks shall be welded and inspected by either the liquid penetrant method or the magnetic particle method per ASW D1.1-1972 (Ref 6.3.1).

Rolled steel shapes, plates, and bars for the trash racks shall be ASTM A36 with 0.2 percent minimum copper or ASTM A 441. Structural tubing shall be ASTM A 500, Grade B, or ASTM A 501.

## **2.7 CODE AND STANDARDS**

The traveling water screens, trashracks, screen wash pumps, and piping shall be designed per design classifications as defined in WB-DC-40-64 (Ref 6.2.19) and WB-DC-40-36 (Ref 6.2.13).

The COR for ASME Section III piping systems designed by TVA is the 1971 edition up to and including the Summer 1973 Addenda.

For those components ordered before the adoption of the Winter 1977 Addenda, the COR is that code in effect on the date the contract with the ultimate manufacturer was placed.

For those components ordered after the adoption of the Winter 1977 Addenda, the owner may establish a COR independent of the contract date and dating as early as 3 years prior to the date on which the construction permit application was filed. The COR will be established by the applicable contract for the component.

## **2.8 FIRE PROTECTION**

The traveling screens, as part of the ERCW system, are required to function to assure safe plant shutdown. Consequently, electrical systems for the traveling screens shall meet 10CFR50 Appendix R separation criteria for fire protection (Ref 6.2.7).

## **2.9 STRUCTURAL REQUIREMENTS**

### **2.9.1 Trashrack Design Considerations**

A head differential of 5' shall be used for the trashrack design for live loads.

### **2.9.2 Traveling Screen Design Considerations**

A. Load Combinations and Allowable Stresses

See Table 7.1.

B. Vibration

Not Applicable

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## **2.10 PROCESS AND OPERATIONAL REQUIREMENTS**

Each traveling screen shall be designed per the following criteria:

Basket Travel Speed	10 fpm (nominal)
Minimum submergence:	14'
Maximum submergence:	86.6'
Submergence for Continuous duty:	85.5'
<b>Design flow rate:</b>	<b>25,000 gpm (Ref 6.4.3) [PL-08-1111]</b>
Minimum head differential at 25,000 gpm:	6"
Maximum head differential for motor start:	30"
Minimum operating temperature:	10°F
Bottom of screen well Elevation:	652.0'

**Each screen wash pump shall provide 270 gpm at 350' (Reference 6.4.5)  
[PL-08-1113] head with a minimum of 10.35' NPSH required (Reference 6.4.4)  
[PL-08-1112].**

## **2.11 SINGLE FAILURE**

The screen wash system shall be designed per the single failure criteria as defined in WB-DC-40-64 (Ref 6.2.19) and in WB-DC-40-16 (Ref 6.2.2). As part of the ERCW system, additional single failure requirements for the screen wash system are provided in WB-DC-40-16 (Ref 6.2.2).

## **2.12 CORROSION**

Allowances for the effects of corrosion in the structural integrity of the system will be made.

## **3.0 LAYOUT AND ARRANGEMENT**

The traveling screens shall be located in the IPS. Each screen will be located in a rectangular concrete well with the screen drive mounted at the top of the screen on the deck above the well. Cast-iron guides mounted in the walls of the well support the screen in the lateral direction. Vertical support of the screens is to be at the top of the deck and/or at the bottom of the concrete well. The screen wash pumps and piping shall be located in the IPS above maximum flood level.

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#### **4.0 TESTS AND INSPECTIONS**

A means shall be provided for holding the screens in intermediate positions and for raising and lowering the screens as required for inspection/repair. The screens are to be inspected periodically for operation, wear, and corrosion including: drive components; carrier chains; baskets including the wire panels; spray pipes; spray nozzles; mainframes; lights; and lubricating devices. All rotating machinery is to be monitored periodically for vibrations.

#### **5.0 QUALITY ASSURANCE**

Since the traveling screens, screen wash pumps, piping and valves perform a safety-related function, the QA program shall be per Ref 6.2.4 and 10 CFR 50 Appendix B.

See Section 2.7 for requirements applicable to system/component and design classification. The following further clarify TVA QA requirements:

- A. TVA Topical Report TVA-TR75-1A, Quality Assurance (Ref 6.2.4).
- B. Safety Class Q - Nuclear Quality Assurance Manual (NQAM) (Ref 6.2.14).
- C. TVA Quality Assurance Manual for ASME Section III Nuclear Power Plant Components (NCM) (Ref 6.2.15).
- D. DNE Nuclear Engineering Procedures (NEP) Manual (Reference 6.2.22)

#### **6.0 REFERENCES**

##### **6.1 TVA DRAWINGS**

- 6.1.1** 1-47W845-1 - **Series - Mechanical Flow Diagram - ERCW System [PL-08-1104]**
- 6.1.2** 1-47W610-67 - **Series - Control Diagram [PL-08-1105]**
- 6.1.3** 1-47W611-67 - **Series - Logic Diagram [PL-08-1106]**
- 6.1.4** 1-45W760-67.3 - **Wiring Diagram [PL-08-1107]**

##### **6.2 TVA DOCUMENTS**

- 6.2.1** WB-DC-40-31.2, Seismic qualification of Category I fluid system components and electrical or mechanical equipment.
- 6.2.2** N3-67-4002, Essential Raw Cooling Water System, System Description.
- 6.2.3** WB-DC-40-19, Intake Pumping Station Concrete Structure, Intake Channel, and Retaining Walls.
- 6.2.4** TVA Topical Report TR75-1A, Quality Assurance.

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## **6.2 TVA DOCUMENTS (continued)**

- 6.2.5 WB-DC-30-27, AC and DC Control Power Systems.
- 6.2.6 WB-DC-30-4, Separation/Isolation.
- 6.2.7 WB-DC-40-51, Fire Protection of Safe Shutdown Capability.
- 6.2.8 WB-DC-30-28, Low and Medium Voltage Power Systems.
- 6.2.9 WB-DC-40-29, Flood Protection Provisions.
- 6.2.10 WB-DC-40-65, Missiles.
- 6.2.11 WB-DC-40-42, Environmental Design
- 6.2.12 WB-DC-40-54, Environmental Qualification to 10CFR50.49.
- 6.2.13 WB-DC-40-36, The Classification, Piping, Pumps, Valves, and Vessels.
- 6.2.14 Safety Class Q, Nuclear Quality Assurance Manual (NQAM).
- 6.2.15 TVA Quality Assurance Manual for ASME Section III Nuclear Power Plant Components (NCM).
- 6.2.16 WB-DC-40-31.7, Analysis of Category I and I(L) Piping Systems.
- 6.2.17 WB-DC-40-31.9, Location and Design of Piping Supports and Supplemental Steel in Category I Structures.
- 6.2.18 WB-DC-40-31.12, Seismic Qualification of Category I and I(L) Valves and Other Online Fluid System Components.
- 6.2.19 WB-DC-40-64, Design Basis Events.
- 6.2.20 WB-DC-30-20, Control Panels.
- 6.2.21 (MEB770224011), Contract Correspondence Approving Seismic Analysis
- 6.2.22 Nuclear Power Engineering Procedure Manual

## **6.3 CODE AND STANDARDS**

- 6.3.1 American Welding Society AWS D1.1-1972.
- 6.3.2 Steel Structures Painting Council Surface Preparation Specification No. 10, Near-White Blast Cleaning.
- 6.3.3 "Specification for Design, Fabrication, and Erection of Structural Steel for Buildings," American Institute of Steel Construction (AISC), 7th Edition with Supplements and/or 8<sup>th</sup> Edition.



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#### **6.4 TVA CALCULATIONS**

- 6.4.1 EPMJKJ101990 (B18 921023 271) ERCW Safety Related Functions and Analytical/Operational limits for Screen Wash Pump Discharge Pressure and Strainer Backwash line differential pressure. [PL-08-1109]**
- 6.4.2 EPMJMC030292 (B18 920526 255) Intake Pumping Station - ERCW pump sump configuration. [PL-08-1110]**
- 6.4.3 EPMRCP052992 (B18 920915 253) Sizing of Traveling Water Screens [PL-08-1111]**
- 6.4.4 EPMWUC072489 (B18 920513 251) NPSH available for ERCW and Screen Wash Pumps. [PL-08-1112]**
- 6.4.5 OHCGWGA030686 (B18 920430 251) Minimum Traveling Water Screen spray pressures and Screen Wash Pump sizing calculation. [PL-08-1113]**
- 6.4.6 Deleted**
- 6.4.7 WBN-OSG4-016 - (B26 920611 288) System NUREG-0588, Category and Operating Times [PL-08-1114]**
- 6.4.8 WBN-OSG4-098 - (B18 920710 329) Mechanical Equipment Qualification List for 10 CFR 50.49 Events [PL-08-1115]**
- 6.4.9 34N210C7 - (B18 930323 257) Seismic Evaluation of IPS Traveling Water Screens [PL-08-1125]**

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## 7.0 TABLES

### 7.1 Load Combinations and Allowable Stresses.

TABLE 7.1  
LOAD COMBINATIONS AND ALLOWABLE STRESSES  
STRUCTURAL PARTS

<u>No.</u>	<u>Load Combinations</u>	<u>Allowable Stresses (PSI)</u>	
		<u>Tension and Compression</u>	<u>Shear</u>
I	Dead Live with water at El 683.0' and 2'-6" head loss Impact from live load	0.56 Fy	0.38 Fy
II	For headframe only Dead Live with water at El 683.0' and 2'-6" head loss Impact from level load Snow and ice	0.56 Fy	0.38 Fy
III	Dead Live with water at El 713.0' and 2'-6" head loss *OBE	0.56 Fy	0.38 Fy
IV	Dead Live with water at El 695.0' and 2'-6" head loss *SSE	0.9 Fy	0.6 Fy
V	Dead Live with water at El 736.9' and 5'-0" head loss Impact	0.9 Fy	0.6 Fy
VI	Dead Stall at 300% capacity	0.9 Fy	0.6 Fy

\* Acts in one horizontal direction only at any given time and acts in vertical and horizontal direction simultaneously.

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**7.1 Load Combinations and Allowable Stresses. (continued)**

TABLE 7.1  
LOAD COMBINATIONS AND ALLOWABLE STRESSES  
OTHER PARTS

<u>No.</u>	<u>Load Combinations</u>	<u>Allowable Stresses (PSI)</u>	
		<u>Tension and Compression</u>	<u>Shear</u>
I	Dead Live with water at EI 683.0' and 2'-6" head loss Impact from live load	<u>Ultimate</u> 5	<u>2x Ultimate</u> 15
II	For headframe only Dead Live with water at EI 683.0' 2'-6" head loss Impact from live load Snow and ice	<u>Ultimate</u> 5	<u>2x Ultimate</u> 15
III	Dead Live with water at EI 713.0' and 2'-6" head loss *OBE	<u>Ultimate</u> 5	<u>2x Ultimate</u> 15
IV	Dead Live with water at EI 695.0' and 2'-6" head loss *SSE	0.9 yield	0.6 yield
V	Dead Live with water at EI 736.9' and 5'-0" head loss Impact	0.9 FY	0.6 Fy
VI	Dead Stall at 300% capacity	0.9 Fy	0.6 Fy

\* Acts in one horizontal direction only at any given time and acts in vertical and horizontal direction simultaneously.

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## 7.2 Major Components Parameters.

TABLE 7.2  
MAJOR COMPONENTS PARAMETERS

### SCREEN WASH PUMPS

Quantity	1 per ERCW train per unit (4 total)
Type	Centrifugal vertical turbine
Design Capacity, gpm (each)	270
Design Head, feet	350 TDH
Rated Motor Horsepower	40
Maximum Shutoff Head, feet	504
Operating Speed, rpm	1760
NPSH required, feet	10.35
NPSH available (minimum), feet	42.35
Manufacturer	Johnston Pump Company, Glendora, CA (File N3M-292)
Contract	76K31-820344

### TRAVELING WATER SCREENS

Quantity	1 per ERCW pump well serving 2 ERCW pumps (4 total)
Design Capacity, gpm	25,000 per screen at max. velocity of 2.0 fps
Screen openings	3/8" x 3/8"
Maximum Head Loss	2'-6" of water
Screen Basket Size	4' long x 2' wide
Motor Drive	Minimum 3.0 hp
Manufacturer	Envirex Inc.
Contract	74C38-85143

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**Source Notes  
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<b>Number</b>	<b>Source Document</b>
1.	55E NCR WBN MEB 8408
2.	50.55E - 390/81-53

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**Attachment 1  
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**ABBREVIATIONS AND ACRONYMS**

ac	-	alternating current
ASTM	-	American Society for Testing and Materials
COR	-	Code of Record
DBE	-	Design Basis Event
dp	-	differential pressure
EI	-	Elevation
ERCW	-	Essential Raw Cooling Water
fpm	-	feet per minute
gpm	-	gallons per minute
hp	-	Horsepower
HPFP	-	High Pressure Fire Protection
Hz	-	Hertz
IPS	-	Intake Pumping Station
MCR	-	Main Control Room
NPSH	-	Net Positive Suction Head
OBE	-	Operating Basis Earthquake
ph	-	phase
psig	-	pounds per square inch gauge
QA	-	Quality Assurance
RCW	-	Raw Cooling Water
rpm	-	revolutions per minute
SSE	-	Safe Shutdown Earthquake
SWP	-	Screen Wash Pump
TDH	-	Total Developed Head
V	-	Volt