CITY OF HASTINGS, NEBRASKA
ADDENDUM NO. 1, 9-5-2025
TURBINE AND VALVE OVERHAUL
WHELAN ENERGY CENTER, UNIT 1
Contract No. HU 2025-89

The following are responses and clarifications to questions received by various bidders.

1. Turbine rotor dovetail inspection. Please provide clarification of inspection desired/required and number of rows required. **RESPONSE:** *We would like to inspect the tangential-entry wheel dovetails of all the rows. We would like to do phased array inspection along the disk rim blade attachments on the rotor to internally inspect the dovetails. No removal of blading is desired. There are 8 HP stages, 6 IP stages, and 6 LP stages. The last stage bucket dovetail has a pinned connection and should be inspected for cracked pins in accordance with GEK46362b. Please see attached pictures of the rotor.*

2. Phased array inspection requested on how many rows? **RESPONSE:** *Please see above. We would like all the stages possible. We have had success with the PAUT on smaller rotors, so anticipate that all the stages should be inspectable (except the last stage). However, if geometry or other limitations prevent inspection of one or both sides of a stage, that will be acceptable. Contractor to plan on an initial trip upon initial removal of the rotor to determine tooling (customized wedges) and to gather information on dovetail design from the GE technician.*

3. Does HU have an extensionometer to measure bolt lengths? **RESPONSE:** *If you are asking for one to use on the coupler bolts, we do have a homemade extensionometer that you can utilize. If there is a different need, we do not have the equipment onsite for it, so the Contractor should plan on providing it.*

4. Can HU provide the bolting diagram for the turbine casings on this unit? **RESPONSE:** *The information from the manual is attached. If additional information is required, we will work with the selected contractor and the GE technician for additional drawings and/or information.*

5. Start-up to include operational check of the NRV. No work scope has been included for NRV inspections. Is HU interested in performing NRV inspections during this availability? **RESPONSE:** *No NRV work by the contractor is anticipated or needs be included in their proposal. The air cylinders are the only required part that are due for inspection at that time. Plant maintenance has been rebuilding those. During start-up, contractor and HU maintenance to verify the proper operation of the non-return valves.*

6. What date is shut-down? Need to collect pre-outage performance data. **RESPONSE:** *Around midnight on March 20th, 2026, is the scheduled shut down date. Any pre-outage performance data should be coordinated for the 18th or 19th.*

7. Under general provisions, it is stated that the contractor shall conduct rotating balancing if required. If no repair activities are performed, is it the intent of HU under the base scope/pricing that the contactor should have a vibration engineer on standby for start-up to analyze and correct unit balance if necessary? **RESPONSE:** *Correct. HU would like the contractor to have a vibration engineer on standby to analyze and correct unit balance if necessary.*

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8. Does HU have a preferred insulation provider? Please provide contact information. **RESPONSE:** *We have been utilizing ISSP Services LLC. Ruben Alvarez, 832-419-5981, ruben_@isspservices-llc.com. Contractor can use any vendor that they have a relationship with. Providing ISSP's contact information for information only.*

9. Combined Reheat valve scope says to "Skim cut to cleanup seating surfaces". Please provide seat diameter and profile for the area to be cut. Valve drawings would be ideal. **RESPONSE:** *This was a recommendation from the 2023 valve overhaul. A cross section of the ICV/RHSV is attached. At this point we do not have the seat diameter and profile. We will work with GE's technician and the contractor to gain this information prior to the overhaul.*

10. There are concerns about the economics of steam path audits. **RESPONSE:** *Hastings Utilities will consider the pricing and weigh the benefits of this option. Concerns about the economics are noted.*

11. Option for boresonic inspection: Is this request to be applied to the LP rotor ONLY? Or all three turbine rotors? If more than the LP alone, please be advised that disassembly of the mid-span couplings will be required as well as provision of stub shafts for the disassembled turbine rotors shall be required. As such, new bolting should be on-hand for the IP/LP coupling. If HP and IP rotor bores are to be inspected, please provide bore diameters, lengths, and profiles. **RESPONSE:** *Please quote the LP rotor only. We've looked through previous boresonic records and consulted with GE Vernova Engineering. The HP rotor is too small for a boresonic inspection. The IP section we'd prefer to not persue due to disassembly requirements between the IP and LP sections. The previous LP rotor boresonic inspection is attached.*

12. 3.007 Laser Alignment, is it possible for HU to contract? **RESPONSE:** *Yes, it is acceptable if the contractor does not want to provide the laser alignment company. Please take exception to providing the Laser Alignment in your proposal.*

13. 3.009 General - Insulation. Can your scaffold contractor do the insulation? **RESPONSE:** *Yes, it is acceptable if the contractor does not want to provide the insulation scope. Please take exception to providing the Iinsulation Scope in your proposal.*

14. 3.009 Packing. RFQ asked for 8hrs for packing cleaning/scraping, which seems low. Also, there were concerns about the amount of manhours specified for lapping, bluing, and alignment. **RESPONSE:** *To make the bids more comparative, I've rolled the anticipated hours into a new section and added additional hours..*

15. No generator work other than collector rings, right? **RESPONSE:** *Correct. The generator overhaul was completed in 2023 when we had some issues.*

The following bid sections were updated accordingly:

- Section 3.009 – Extra Work – *Added new sub-section. This is to help qualify bids and to create a pool of hours incase underruns and overruns for these tasks occur.*

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- Section 3.009 – *Changed from included hours to estimated hours. Asking contractor to pool these together and provide 225 hours of lapping, bluing, scraping, and alignment. If contractor feels this number is too high or too low, please note the actual hours bid in your exceptions page.*

- Provided the following information with this addendum:

    - *Overall Picture of the rotor*
    - *Picture of the last stage dovetail pinning*
    - *Provided GE's bolting information*
    - *Provided Combined Reheat Valve information*
    - *Provided NuVision 2007 Borescopic report*

CITY OF HASTINGS

By Derek Pfeifer

Title Production Engineer

The undersigned bidder hereby certifies that the revision set forth in this addendum have been incorporated in their bid and are a part of the contract documents.

Signed _____

Title _____

Firm _____

Date _____

ALL ISSUED ADDENDUM(S) MUST BE ACKNOWLEDGED
& RETURNED WITH YOUR BID DOCUMENTS

SECTION 3-0 GENERAL DESCRIPTION AND SCOPE OF WORK

3.001 General. Hastings Utilities (HU) is accepting bids to provide skilled craft labor with supervision for the overhaul of its Reheat Single Flow 76.3 MW GE Steam Turbine and Valves for Unit 1 at Whelan Energy Center, 4520 East South Street in Hastings, Nebraska.

The bidder is encouraged to visit the site prior to submitting a bid. The Bidder shall inform themselves of all conditions and factors which would affect the execution of the work. No claims for financial compensation or time extension, based on the lack of such prior information (or its effect on the cost of the work) will be permitted by the Owner. Please contact Derek Pfeifer, Production Engineer, at 402-462-3673 if you have any questions about this project, would like to arrange a site visit, or would like to get share point access to previous inspection reports.

Contractor's proposal shall include all skilled labor, management, tools, and equipment as necessary to meet the scheduled outage window. The proposal shall include all straight time, overtime, double time, travel, per diem, and taxes.

3.002 Schedule. This shall include the completion of various activities in accordance with the milestone time periods and dates listed.

Activity	Schedule
Bid Opening	September 25, 2025
Contract Award Date	October 7, 2025, Pending City Council Budget Approval
Outage Dates	March 20 through May 1, 2026
Complete Work	End of Day April 29, 2026

3.003 Hours & Crew Makeup. The Contractor's proposal shall include an anticipated schedule, including proposed shifts, working hours, and crew size as necessary to meet the scheduled outage window.

3.004 Time & Material Rates. The Contractor's proposal shall include the T&M rate sheets for labor and equipment.

3.005 Technical Advisor Role. A GE Technical Advisor will be provided by HU. The TA's schedule will be Monday through Saturday, 7am until 5pm.

3.006 Non-Destructive Testing Examination. All non-destructive inspection must be performed by an ASNT Level II or Level III technician operating under current qualified NDE procedures in accordance with ASNT SNT-TC-1A. Contractor to provide qualification records and procedures to Owner prior to conducting examinations.

3.007 Laser Alignment. The successful bidder shall subcontract with Sam Pauly of Turbine Laser Alignment, LLC for turbine laser alignment of diaphragms and bearings.

SECTION 3 - GENERAL DESCRIPTION AND SCOPE OF WORK

3.008 Division of Responsibilities.

No.	Mobilization and Pre-Outage Site Preparation	PLANT	CONTRACTOR
1	Set up staging area for tooling and materials with 100 feet of work area.	X	
2	Provide parking for Contractor personnel near the work site.	X	
3	Set up laydown space within 100 feet of work area.	X	
4	Install protective floor covering.		X
5	Protective floor covering material.	X	
6	Provide a temporary site office with phone near work area.		X
7	Provide guest internet wifi access for the site office	X	
8	Set up craft labor break and change facilities near work area.		X
9	Provide restroom facilities in the form of portable toilets and wash stations	X	
10	Provide drinking water for employees		X
11	Receive, off-load, and stage Contractor tools and equipment.		X
12	Stage replacement parts in accessible location for Contractor.	X	
13	Provide electrical service to the work area and make connections as needed.	X	
14	Provide and connect temporary lighting for the laydown and work area.	X	
15	Route service water to work area as needed.	X	
16	Provide compressed air to work area as needed.	X	
17	Provide suitable containers for trash and disposal of trash from containers as required.	X	
18	Provide wood for timbers, skids, cribbing, pallets, work benches, etc.	X	
19	Fitness for Duty (drug and alcohol testing) program and implementation for Contractor labor.		X
	Outage Support Functions		
20	Provide, install, and remove OSHA approved scaffolding, as needed. Contractor to provide direction as needed to PLANT.	X	
21	Disconnect/reconnect instrumentation and instrumentation lines as needed.	X	
22	Disconnect/reconnect hydraulic lines as needed.		X
23	Operating personnel to perform shutdown, startup, draining and filling of oil system, and other normal operating functions.	X	
24	Inspect, repair, and calibrate all pressure and temperature indicating gauges, switches, transducers etc.	X	
25	Local machine shop facilities and on-site machining are available for smaller items.	X	
26	Provide crane(s) as necessary for work during the time Contractor is on site. This includes both the overhead crane and any manual gantry cranes.	X	
27	Provide trained crane operator(s) as needed.		X
28	Provide pre-outage certification of overhead crane.	X	
29	Provide welding and stress relief equipment and service, as necessary, at PLANT.	X	
30	Provide oxygen, acetylene, hydrogen, carbon dioxide, argon, and others, as necessary.	X	
31	Provide NDE equipment and personnel.		X
32	Provide new and replacement parts.	X	

33	Provide solvents and appropriate rags.		X
34	Provide all electrical disconnects/reconnects for removal/installation as needed.	X	
35	Repaint components as necessary.	X	
36	Remove and install fire protection piping as necessary. Wiring removal by HU.		X
	Work Scope Specific Responsibilities		
37	Manage FME program and associated equipment.		X
38	Provide confined space program, equipment, watch personnel, and air monitoring.		X
39	Provide plant specific tools originally supplied by the OEM (lifting devices, special wrenches, rigging, etc.).	X	
40	Provide gaskets and gasket materials as required.	X	
41	Provide fork trucks and electric pallet jack if needed.	X	
42	Provide fork truck operator if needed.	X	
43	Provide bolt heating services.		X
44	Remove/ install insulation as needed.		X
45	Provide blast cleaning, including equipment, material, and personnel.		X
46	Provide non-specialized rigging equipment (slings, etc.)		X
47	Provide lapping blocks and try bars.	X	
	Administrative		
48	Provide site outage organization chart and emergency numbers.	X	X
49	Provide personal protective equipment for Contractor's personnel.		X
50	Provide technical direction and advice to PLANT personnel.		X
51	Provide access to GE design engineering support and drawings to Contractor through GE TA	X	
52	Provide one point contact per shift.	X	X
53	Furnish liason to facilitate locating and supplying spare parts, etc., and to make decisions pertaining to unusual conditions or repairs found during the project.	X	
54	Manage and provide data sheets and documentation.		X
55	Provide a project schedule and daily onsite updates.		X
56	Provide progress reports for work completed and planned.		X
57	Provide Site Safety Orientations to all Contractors	X	
58	Attend mandatory Site Safety Orientations and adhere to the Site safety plan.		X
59	Complete Lockout/Tagout.	X	
60	Review Lockout/Tagout.		X
61	Provide Hotwork Permits	X	
62	Provide First 1 hour of Firewatch		X
63	Provide Last 3 hours of Firewatch	X	
64	Approve Extra Work Authorizations (EWA's), if necessary.	X	
65	Provide first aid supplies and facility.	X	
66	Provide access to an ambulance service.	X	
	Waste Removal and Control		
67	Keep work area clean.	X	X

68	Dispose of all fluids, solvents, and hazardous materials or wastes (solid and/or liquid) that are used in conjunction with or because of the project.	X	
69	Responsible for all asbestos insulation or asbestos material identification, removal, and disposal.	X	
70	Responsible for removal and disposal of all lead paint.	X	
71	Disposal of scrap parts.	X	
	Demobilization		
72	Arrange for the return shipping of all Contractor tools and equipment.		X

3.009 Work included under these specifications. Contractor will be responsible for supplying the following materials, equipment, and services in addition to the division of responsibilities above.

General:

- Ensuring the safety of the existing plant equipment during the overhaul processes
- Arrangements and transportation for any outside machine shop or repair facility for component(s) repair needed to complete project. Costs of transportation by Owner.
- Conduct any rotating equipment balancing refinement required
- Perform any unit alignment changes if required.
- Removal and replacement of lagging.
- Remove, supply and install insulation.

Project Management: Provide planning, scheduling, coordination, and full-time supervision of all work being performed on the units' turbine, valves, controls and associated equipment as specified. The Contractor's team will manage the following tasks to ensure all checks are completed:

- Project planning, scheduling and manpower projection, using computer-based planning and scheduling tools. A Critical Path Method (CPM) schedule will be provided to the Owner for review at least 60 days before commencement of overhaul.
- Coordinate turbine and component open, inspection, and closing. Engineering recommendation and modifications as required by this scope.
- Coordinate and work with GE TAs and customer supplied personnel for successful and on time completion of the project.
- Coordination and supervision of all Contractor supplied personnel and/or subcontractors.
- Scheduling and coordination of blast cleaning, NDE, electrical testing and all other Contractor provided subcontractors, as supplied.
- Monitoring and evaluating activities to ensure the project is on track for schedule completion.
- Provide competent project management personnel well versed in GE Steam Turbine equipment engineering, maintenance and operating practices. A completed resume and

job history will be provided for all contractor-supplied personnel (this is not required for craft labor).

Extra Work Manhours – In the sections below, estimated times for scraping, bluing, lapping, and alignments are provided. Contractor to assume 225 manhours total to be spread across these tasks. Additional hours will be handled on a T&M basis.

Alignment Checks – Alignment checks will be made as listed below. If major misalignment is indicated because of these checks, or because of major parts change-out, the required realignment will be handled as an extra cost item. All alignment and clearance checks are to be made with the unit cold unless otherwise noted.

- Gib key clearance checks.
- Rub check on radial steam baffles.
- Check points of axial rubbing.
- Check coupling alignment at assembly.
- Coupling alignment will be checked at disassembly if unit is cold.
- Diaphragm alignment.
- Turbine/Generator Coupling
- Estimated 100 manhours of alignment total for couplings and diaphragms. Additional hours will be handled on a T&M basis, as described above in the extra work section.

Rotor Position

- Check and record wheel, diaphragm, packing clearances and rotor position at disassembly.
- Spot check wheel, diaphragm packing clearances and rotor position at reassembly.

Bearings

- Check and record the condition of Babbitt, ball seat, and journals (visual).
- Record bearing contact area (journal and thrust bearings).
- Lightly clean bearing Babbitt surface(s) to remove any embedded foreign particles.
- Check and record journal clearances. Recommend corrective action as necessary.
- Visually examine bearing ring to ball seat and bearing cap contact. Check and record pinch on each bearing.
- NDE examine bearing mating faces
- Measure and record diameters of bearings.
- Measure and record bearing twist and tilt as required.
- Measure and bump check thrust bearing clearance. Taper and flatness checks per GEK-46382C specifications.
- Remove, disassemble, inspect reassemble and align thrust bearing wear detector.
- Check all oil strainers.

- ~~Include~~ Estimated 10 manhours of bluing and scraping (including consolidating shims) per bearing to achieve acceptable contact. Additional hours will be handled on a T&M basis, as described above in the extra work section.

Turbine Rotors

- Indicate and record rotor runouts.
- Remove turbine rotors.
- Make visual inspection of rotors.
- Record size and physical condition of journal surfaces.
- Visually examine condition of coupling face, rabbet fit and bolt holes. Measure and record coupling fits.
- Determine rub pattern and record.
- Visually examine notch block and bucket pins for evidence of movement.
- Examine balance weights; check for tightness; record position of weights in all rings.
- The male spigot on the turbine rotor coupling should be machined true to the journal if the rotor goes to the shop. If the rotor does not necessitate going to the shop, an option for onsite machining will be done on an Extra Work Authorization basis.
- Inspect Dovetail Pins on blading
- Examine wheel dovetails with Phased Array

Diaphragms

- Remove diaphragms, as necessary.
- Make visual inspection of partitions, steam joints, keys and bridges.
- Record unusual erosion patterns.

Shells and Exhaust Hood (upper Halves Only, Removed)

- Visually examine upper and lower interior surfaces, ledges, struts, heat baffles, and companion fits for erosion, distortion and/or galling.
- Clean horizontal joints and examine for distortion.
- Examine (visual only) drain holes for blockage and/or erosion.
- Visually inspect atmospheric relief diaphragms.
- Visually inspect all bolting and record bolt extensions.
- Re-assemble using applicable high temperature joint compound and thread lubricant. Stress joint bolts as necessary and record stress valves.

Packings

- Record condition of steam packing and springs.
- Record condition of diaphragm packing and springs.
- Sharpen teeth, as required.
- Clean, as required.

- ~~Include~~ Estimated ~~8~~ 40 manhours of packing scraping and cleaning. Additional hours will be handled on a T&M basis, as described above in the extra work section.

Oil Deflectors

- Record conditions.
- Clean, as required.
- Record clearances.

Valves – Normal inspection work will consist of visual examination and re-establishing design stem-to-bushing clearance by cleaning. ~~Include~~ Estimated 4 manhours of valve lapping per valve seat, 2 manhours of valve pressure seal head lapping per valve, and 2 manhours of valve bushing honing per valve. Additional hours will be handled on a T&M basis, as described above in the extra work section.

Main Stop Valve (1 Each)

- Disassemble steam side only for inspection.
- Check condition of discs and seats (visual) including contact check between seat and disc.
- Record clearances and check runout of stems (3 locations).
- Clean stems and bushing, as required per try bar test.
- Visually examine steam strainers, including NDE. Clean as necessary.
- Visually and NDE examine bypass valves, seats, welds, sealing faces, back seats, steam dams, discs, valves, poppets, bonnet mounting studs, and bearings
- Record bolt extensions.

Control Valves (1 Upper, 1 Lower. Each has 3 individually mounted cam operated valves.)

- Check condition of discs and seats (visual) including contact between seats and discs.
- Record clearances and check runout of stems (3 locations).
- Clean stems and bushings, as required by try bar tests.
- Inspect linkages, pins, camshaft components, spring cans, camshaft components, valve stems, valve racks, bushings, and bearings.
- NDE examine valve stems, poppet valve shanks.

Combined Reheat Intercept and Stop Valves (2 Each – 1 Left, 1 Right)

- Disassemble steam side only for inspection.
- Check condition of discs and seats (visual) including contact check between seat and disc.
- Skim cut to clean up the seating areas on both valves
- Record clearances and check runout of stems (3 locations).
- Clean stems and bushing, as required per try bar test.
- Inspect linkages, pins, pilot valves, stem components, sleeves, bushings, and bearings.

- NDE examine seats, welds, steam dams, sealing faces, seating surfaces, back seat areas, bonnet mounting studs
- Visually examine steam strainers, including NDE. Clean as necessary.
- Record bolt extensions.

Turning Gear

- Examine gears for contact pattern and condition.
- Check clearance between clash gear and bull gear.
- Check engaging mechanism.
- Install new replacement hydraulic cylinder.

EHC System – Normal inspection work will consist of the following items:

- Visually inspect the power unit.
- Clean the fluid reservoir after the fluid has been removed.
- Remove and visually inspect strainers/ filters and replace as required.

Lubrication System

Oil Tank

- Visually inspect condition of oil tank, clean, if necessary, and check all unions and flanges for tightness.

Bearing & Seal Oil Pumps

- Disassemble impeller casing and check seal ring clearances.
- Visually inspect impeller and casing.
- Clean and inspect screens.

Emergency Bearing & Seal Oil Pump

- Disassemble pump and record bearing and seal ring clearances.
- Inspect condition of component parts.
- Clean and inspect screens.

Oil Flush

- Clean spare oil transfer tank before outage ends and transferring begins.
- A mini lube oil flush will be performed which consists of installing fine mesh screens, supplied by Purchaser, on the in-line bearing strainers and running the lube oil system for a period not to exceed 24 hours total operation. Additional oil flushing, if required, will be an extra to the contract.

Seal Oil Skid

- Disassemble and inspect the differential pressure regulator.

Generator, Exciter, and Hydrogen Systems – These systems were inspected and overhauled in 2023. No work is necessary for these items, except for inspecting the collector rings. Contractor to remove brushes, brush assembly, inspect and measure the collector rings, and reinstall assembly.

Start-up and Check-out - Operational checks after completion of overhaul shall be made jointly with Contractor and Owner personnel.

Prior to Start-Up

- Check foundation for interference and expansion restrictions.
- Check operation of main stop, control and combined valves.
- Check operation of oil pumps.
- Check operation of non-return valves.
- Check all trips, drains, and run-backs.

During Start-Up

- Check vibration readings.
- Check unit temperatures.
- Check governor exerciser.
- Check thrust bearing wear detector settings.
- Check trip anticipator and/or backup overspeed trip.

Operation (Unit Synchronized)

- Check vibration readings
- Check valve testing devices for proper operation.
- Check performance data at same loads recorded prior to shut down.

Reporting – Contractor to provide a comprehensive written report that covers the inspection, conditions found, work performed, clearances and operational data recorded, rework of hardware and usage of spare and renewal parts.

3.010 2019 and 2023 Overhaul Recommendations. The following recommendations were made during the previous turbine overhauls in 2019 and 2023. Hastings Utilities will be responsible for purchasing material in this list. These recommendations are being provided to give the bidder a better idea of the work that might be needed during the overhaul in addition to the inspection.

- Collector Rings – Monitor condition at next outage
- Oil Deflectors – Recommend having T2 and T4 Outboard oil deflectors in stock for next outage.

SECTION 3 - GENERAL DESCRIPTION AND SCOPE OF WORK

- Steam Path Alignment and Clearances – During next scheduled outage recommend a Steam Path Audit evaluation be conducted. Consider having new packing available at next scheduled outage. The conditions of all packing was acceptable for continued service however; clearances were increased of design specifications. Depending on the condition of 9th stage buckets and diaphragm at next outage cycle consideration may be given to coating replacement 10th stage buckets and diaphragm as well. Recommend all RH/LP U/H diaphragms have elevation screws inserted or weld repaired to original size during next outage. The worst are the LP stages.
- Bearing Inspections – Turbine/Generator – Continued regular bearing inspections performed at normal intervals is recommended.
- TE Hydrogen Seal Casing – Recommend replacing T/E Oil Deflector next outage. The T/E H2 Seal casing Oil Deflector will need to be under sized from drawing #356C317 dimensions to 12/010" inside (A) diameter
- Hydrogen Seal Inspections – TE & CE – Before next outage it is recommended that the spare set of hydrogen seals be inspected both dimensional, and flatness. It is further recommended that these be stored in a wooden box till needed.
- Thrust Bearing Inspections – Recommend old thrust plates be refurbished or new be purchased and maintained in stock inventory. During next outage this thrust should be fully assembled prior to coupling assemble.
- Lubricant – Recommend ordering 8 quarts of Bal 200 lubricant for rolling the rotor on bearings for charting and alignment checks as it is much better than turbine oil.
- Coupling – Recommend purchasing new coupling bolt lock tabs. The Turbine rotor coupling should be cut to correct the dishing that was documented in the 2023 report. The male spigot on the turbine rotor coupling should be machined true to the journal while the rotor is in the shop. During the 2023 inspection, the current repair ring was installed on the male spigot with known runout and then the repair ring was cut true to the journal.
- Generator – Recommended installing more pumping ports in the generator end bells
- Bearing Saddle Pads – Recommends planning for additional time for scraping and contact checking the bearing saddle pads. The machining in the pedestals is of very low quality and it is very difficult to match the pads to the pedestal fit. Another option would be to have the fits re-machined to restore the design finish and flatness.
- Main Stop Valve Stem – Replace spare that was used in 2023
- ICV/RHSV Seats – Should be skim cut to clean up the seating areas on both valves during the next major inspection

- ICV – New ICV poppets and bushings along with associated bolting should be purchased for replacement for spares

- ICV Stem Back Seat – The lower bushings that incorporate the ICV stem back seat should be purchased for replacement spares

3.011 Optional Scope Bid Item – Steam Path Audit. The Owner is interested in potentially having a Steam Path Audit (SPA) completed by the Contractor based on the GE recommendation. The SPA should provide the owner with a detailed stage-by-stage thermal analysis of performance losses and a structural assessment of the steam path. The SPA will make recommendations to allow the Owner to make a cost-effective repair and/or maintenance decision during the outage.

The thermal SPA should help identify the source of performance degradation, quantify loss mechanisms, and summarize the cost/benefit of repair options. The performance analysis should break down identified stage losses into seven components: excess diaphragm packing leakage losses, excess diaphragm root radial leakage losses, excess radial tip spill strip leakage losses, nozzle recoverable and unrecoverable losses, and bucket recoverable and unrecoverable losses. Also included should be the end and mid-span packing leakage losses as applicable to the section inspected. Heat rate penalty, kilowatt loss, and excess annual fuel cost should be calculated for each loss. The report should cover each component's recoverable and unrecoverable losses as well as a narrative of the thermal losses observed and the recommendations necessary to recover the losses.

The structural SPA will include a mechanical assessment of the structural integrity of the components. The condition of diaphragms, packing, spill strips, buckets, and rotors will be included. The structural report will include observations concerning the condition of each diaphragm and row of buckets for the turbine sections with recommended repairs and/or alternate repairs for the turbine components based upon projected operational cycle and duty. Expected long-term conditions to be assessed and recommendations included for future outage planning purposes.

Upon completion of the SPA, and before leaving the site, the SPA personnel will meet with the Owner to present the preliminary report. The detailed report will be specific with respect to turbine condition assessment, recommended structural repairs, evaluation of thermal losses, and will include component photographs.

Contractor Scope includes:

- Provide personnel and equipment to perform the steam path audit during the scheduled disassembly of the turbine
- Perform visual inspection and assessment of steam path components
- Take digital photos of steam path components
- Conduct customer meeting prior to departure from site to discuss the Preliminary Report and Recommendations
- Issue Final Steam Path Audit Report in pdf format
- Furnish qualified labor and operate hoist equipment for moving internal turbine parts for inspections and measurements

SECTION 3 - GENERAL DESCRIPTION AND SCOPE OF WORK

Owner Scope includes:

- Provide estimated capacity factor, plant heat rate, and fuel cost values

3.012 <u>Optional Scope Bid Item – Boresonic Rotor Examination.</u> The Owner is interested in potentially having a Boresonic Rotor Examination completed by the Contractor based on the GE recommendation and EPRI guidelines.

LAST STAGE BUCKET DOVETAIL PINNING & WEIGHTS

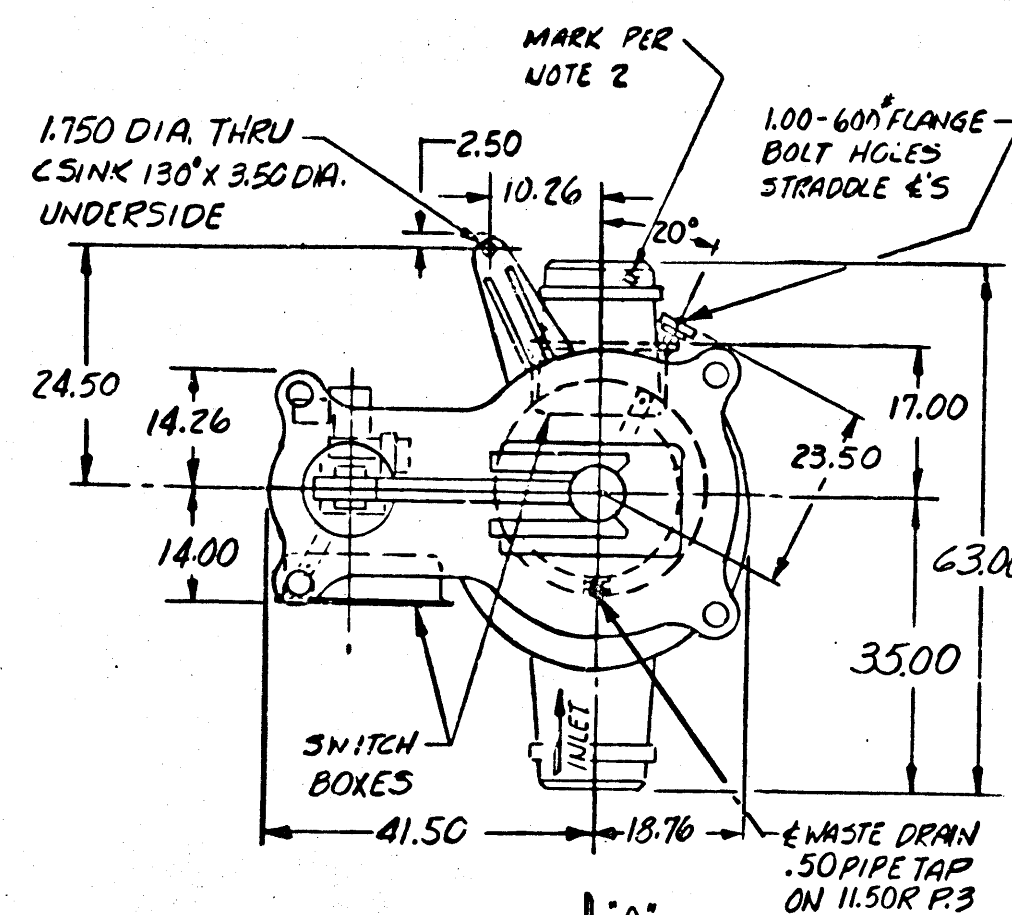
GENERATOR SIDE ROTOR BORED FOR LP BORESONIC.

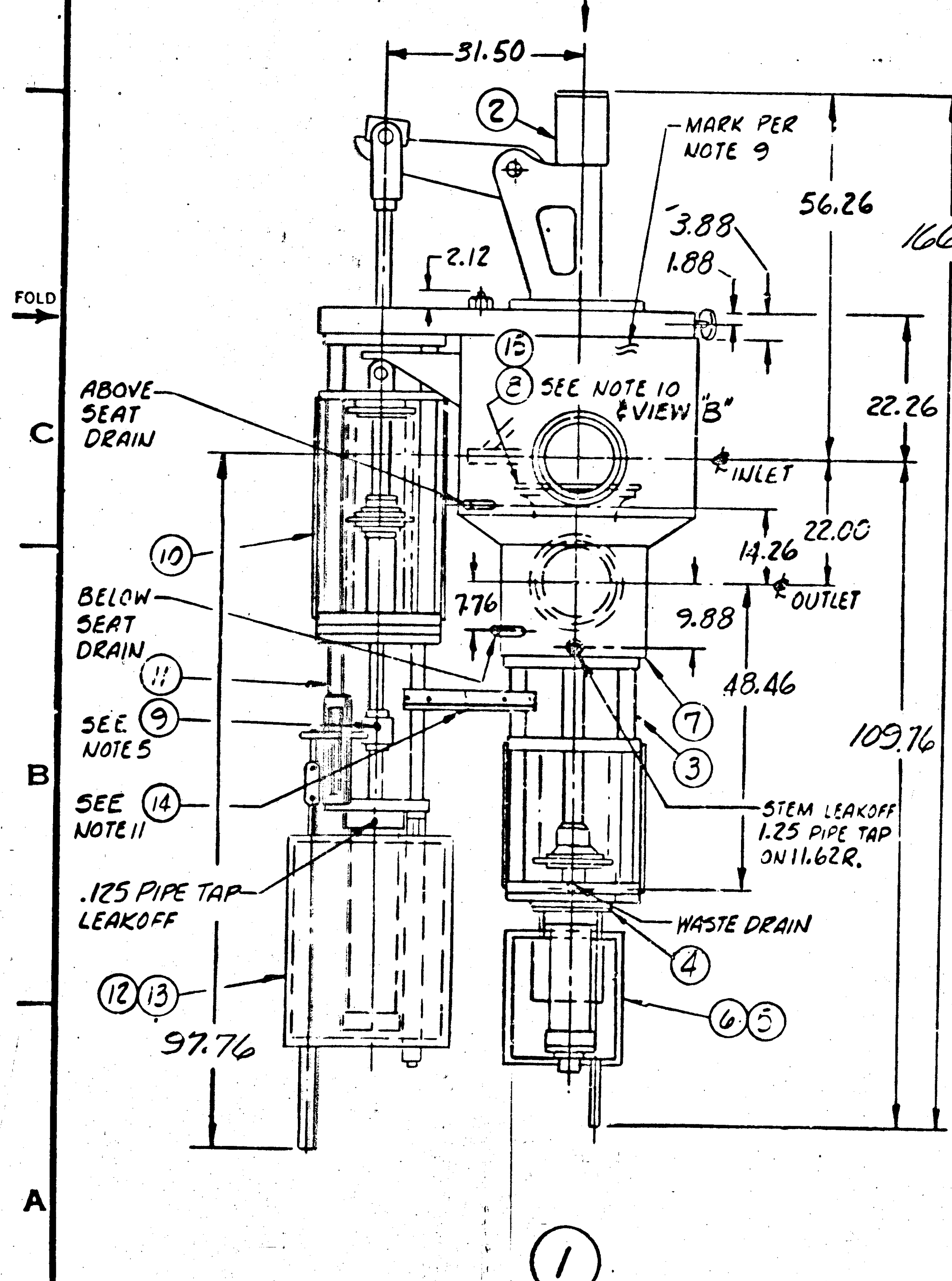
GR	PART NO.	NAME	DRAWING NO.; DESCRIPTION, MATERIAL	WT.
X	1	ASSEMBLY OF PARTS IN G.01		
1	2	VALVE BODY PARTS	7508E57-001	
1	3	CONN. ASSY (RHT)	D-4000J39-023	
1	4	CYL. ASSY (RHT)	819D757-027 (4" CYL.) 120 V.AC SOL	
1	5	SWITCH BOX (RHT)	698E208-063	
1	6	NAMEPLATES	C-5011J62-008	
1	7	VALVE BODY	696E670-001	
1	8	COVER-BLOWDOWN	C-3018J13-001	
1	9	DOWEL	K-4801938-013	
1	10	CONN. ASSY (INCPT)	816D219-001	
1	11	CYL. ASSY (INCPT)	696E672-075 (5" CYL.)	
1	12	SWITCH BOX (INCPT)	698E208-029	
1	13	SOL. CO.IN. & ARC. SUPP.	838B527-009	
2	14	SHIPPING BRACKET	C-3011J95-001	
2	15	BOLT	K-6643028-062 (.750-10X1.25 LG)	

SIZE C 3096J35

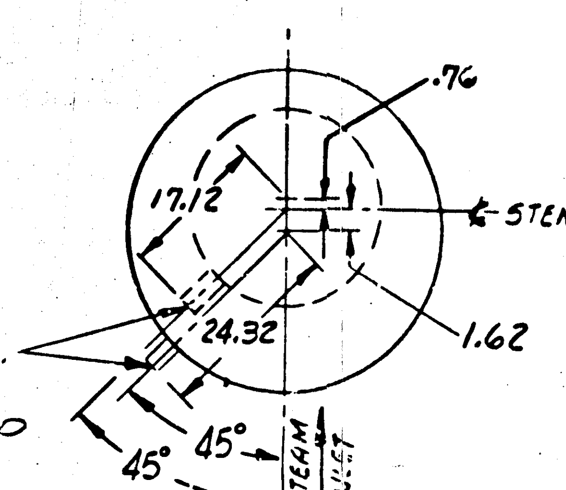
REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	(1) P11 WAS 696E672-068 78RF1084 J. Imara	4/12/79	TJD

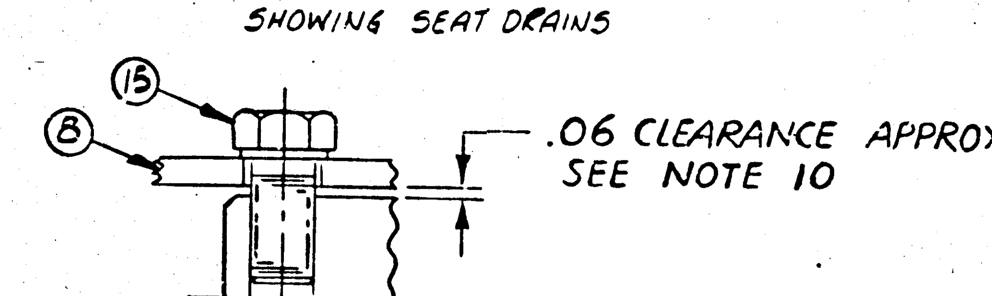




1.375 DIA. C'BORE .50 DEEP FOR 1.00 PIPE BOTH DRAINS.



VIEW AT "A"
SHOWING SEAT DRAINS



ENLARGED VIEW "B"
SHOWING B'DOWN COVER
TORQUED IN POSITION

FOLLOWING INFO TO BE STAMPED ON C-3011J62-005
TURBINE NO. 197799 RATED PRESS 600 PSIG
DRAWING NO. 3096J35 RATED TEMP. 1000°F TT
HYDROSTATIC TEST PRESS. (ASSY) 600 PSIG
HYDROSTATIC TEST PRESS. (VALVE BODY) 1200 PSIG

11. BRACKET 15 FOR SHIPPING ONLY & IS TO BE REMOVED WHEN VALVE IS INSTALLED IN FIELD.
10. COVER TO BE ASSEMBLED ON VALVE SEAT FOR BLOWDOWN OPERATION ONLY. TORQUE EACH BOLT (P.15) TO 125 INCH LBS.
REMOVE AFTER BLOWDOWN.
9. MARK PART IDENT. NO. & REV. LTR. PER P23A-AM1 CL.B.
8. "G" SWITCH IN SWITCH BOX P.12 TO BE SET 2.00 FROM BOTTOM STOP.
7. FOR OIL CONNECTIONS SEE 819D757 AND 696E672
6. APPROX. WEIGHT 13,200 LBS.
5. DOWEL ARM TO COUPLING AFTER MAKING ADJUSTMENTS SPECIFIED ON VALVE BODY PARTS ASSY 7508E57 AND CONN. ASSY 816D219 SEE 696E672 FOR REAMING INSTRUCTIONS.
4. FOR COVER DATA BLOWDOWN SEE 100A728-001
3. MIN DISTANCE ABOVE ℄ OF INLET TO DISASSEMBLE VALVE = 84.00
2. STAMP "TURBINE END" ON OUTLET WITH .38 LETTERS PER P23A-AM1 CL.B.
1. FOR TEST INSTRUCTIONS SEE 200A266.

NOTES:

(1)

FOR GE USE ONLY
SIM TO 3096J22
FCF ON 578L519
UNIT 197799

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES—
TOLERANCES ON: K-1094190
2-PLACE DECIMALS ±
3-PLACE DECIMALS ±
ANGLES ±
FRACTIONS ±
ALL SURF. ✓
MATERIAL—

SIGNATURES	DAY	MO	YR
DRAWN J. Imara	29	4	78
CHECKED			
ISSUED L. Pedersen	2	5	78
ENGRG			
MFG			
MATLS			

GENERAL ELECTRIC
MST DEPT LOC LYNN, MASS.

14EST REHEAT STOP & INTERCEPT VALVE ASSY (LEFT HAND)

SIZE C | CODE IDENT NO. 01289 | 3096J35 | REV. A
SCALE — | SHEET

FN903-F (7-68)
PRINTED IN U.S.A.

CITY OF HASTINGS

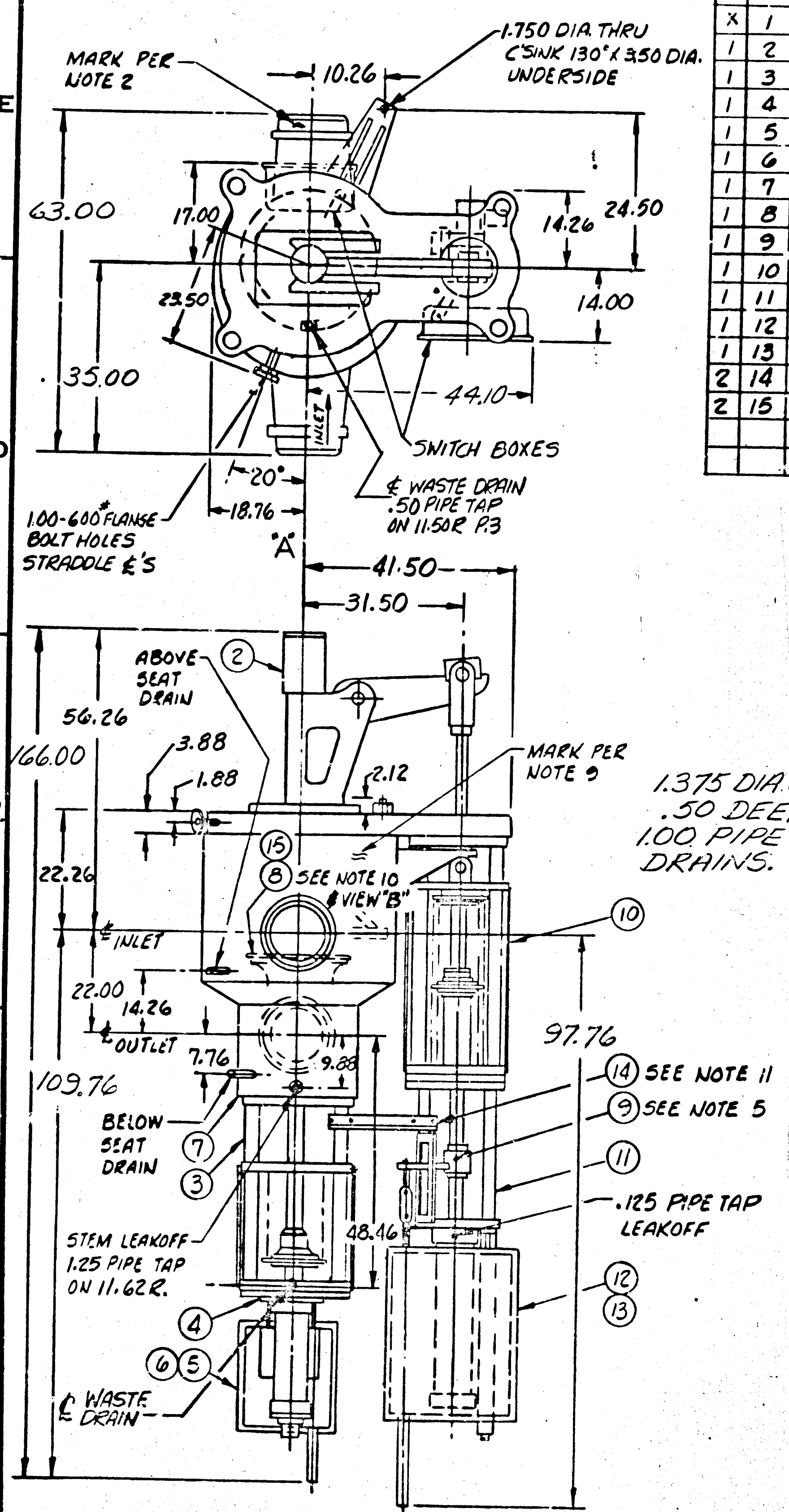
413 42553

SIZE	DWG NO.	SH
C	3096J136	1/1

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	(1) P.11 WAS 696E672-068 78RF1084	7/12/78	

GR 1	PART NO.	NAME	DRAWING NO., DESCRIPTION, MATERIAL	WT
X	1	ASSEMBLY OF	PARTS IN G.01	
1	2	VALVE BODY PARTS ASSY	7508E57-072	
1	3	CONN. ASSY (RHT)	D-4000J39-023	
1	4	CYL. ASSY (RHT)	819D757-027 (4" CYL.) 120 V. AC SOL	
1	5	SWITCH BOX (RHT)	698E208-063	
1	6	NAMEPLATES	C-3011J62-001	
1	7	VALVE BODY	696E670-002	
1	8	COVER-BLOWDOWN	C-3018J13-001	
1	9	DOWEL	K-4801938-013	
1	10	CONN. ASSY (INCPT)	816D219-001	
1	11	CYL. ASSY (INCPT)	696E672-075 (5" CYL.)	
1	12	SWITCH BOX (INCPT)	698E208-029	
1	13	SOL. CONN. & ARC. SUPP.	838B527-009	
2	14	SHIPPING BRACKET	C-3011J95-001	
2	15	BOLT	K-6643028-062 (.750-10 x 1.25 LG)	



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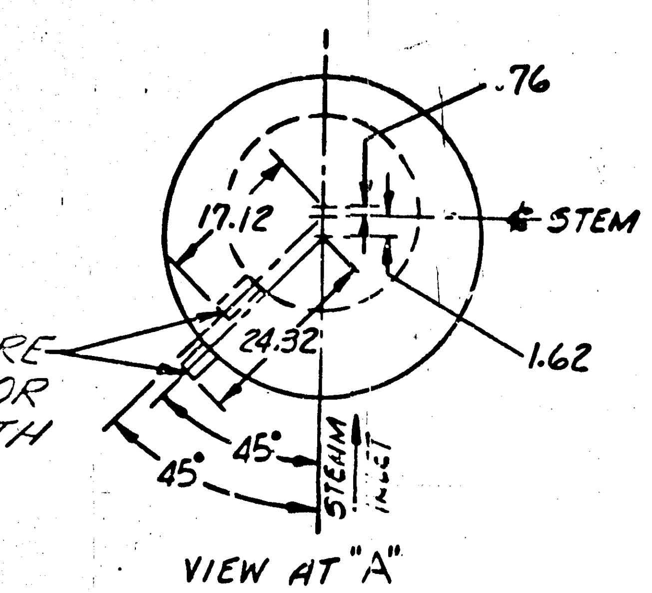
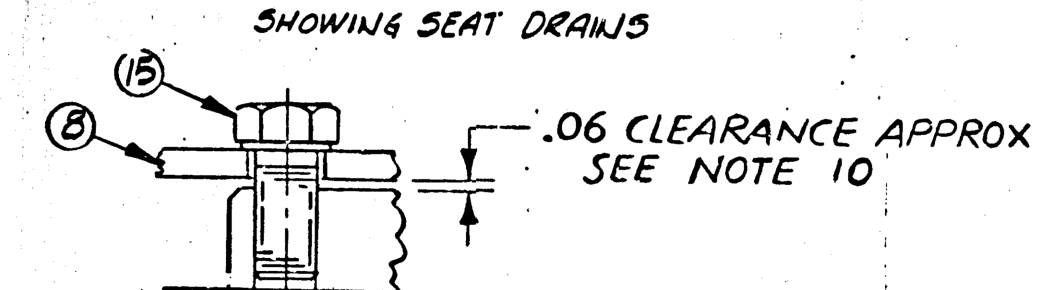


VIEW AT "A"
SHOWING SEAT DRAINS



ENLARGED VIEW "B"
SHOWING B'DOWN COVER TORQUED IN POSITION

FOLLOWING INFO TO BE STAMPED ON C-3011J62-005
TURBINE NO. 197799 RATED PRESS 600 PSIG
DRAWING NO. 3096J136 RATED TEMP 1000°F TT
HYDROSTATIC TEST PRESS. (ASSY) 600 PSIG
HYDROSTATIC TEST PRESS. (VALVE BODY) 1200 PSIG

NOTES:

1. FOR TEST INSTRUCTIONS SEE 200A266
2. STAMP "TURBINE END" ON OUTLET WITH .38 LETTERS PER P23A-AMI CL.B.
3. MIN DISTANCE ABOVE ℄ OF INLET TO DISASSEMBLE VALVE = 84.00
4. FOR COVER DATA BLOWDOWN SEE 100A728-001
5. DOWEL ARM TO COUPLING AFTER MAKING ADJUSTMENTS SPECIFIED ON VALVE BODY PARTS ASSY 7508E57 AND CONN. ASSY 816D219 SEE 696E672 FOR REAMING INSTRUCTIONS.
6. APPROX. WEIGHT 13,200 LBS
7. FOR OIL CONNECTIONS SEE 819D757 AND 696E672
8. "G" SWITCH IN SWITCH BOX P.12 TO BE SET 2.00 FROM BOTTOM STOP.
9. MARK PART IDENT. NO. & REV. LTR. PER P23A-AMI CL.B.
10. COVER TO BE ASSEMBLED ON VALVE SEAT FOR BLOWDOWN OPERATION ONLY. TORQUE EACH BOLT (P.15) TO 125 INCH LBS. REMOVE AFTER BLOWDOWN.
11. BRACKET IS FOR SHIPPING ONLY & IS TO BE REMOVED WHEN VALVE IS INSTALLED IN FIELD.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES—
TOLERANCES ON: K-1094190
2-PLACE DECIMALS ±
3-PLACE DECIMALS ±
ANGLES ±
FRACTIONS ±
ALL SURF. √
MATERIAL—

SIGNATURES		DAY	MO	YR
DRAWN		29	4	76
CHECKED				
ISSUED		2	5	76
ENGRG				
MFG				
MATLS				

GENERAL ELECTRIC
MST DEPT LOC LYNN, MASS.

14 EST REHEAT STOP & INTERCEPT VALVE ASSY (RIGHT HAND)

SIZE	CODE IDENT NO.		REV.
C	01289	3096J136	A

SCALE — SHEET

FOR GE USE ONLY
SIM TO 3096J123
FCF ON 578L518
UNIT 197799

FN903-F (7-68)
PRINTED IN U.S.A.

2-N-

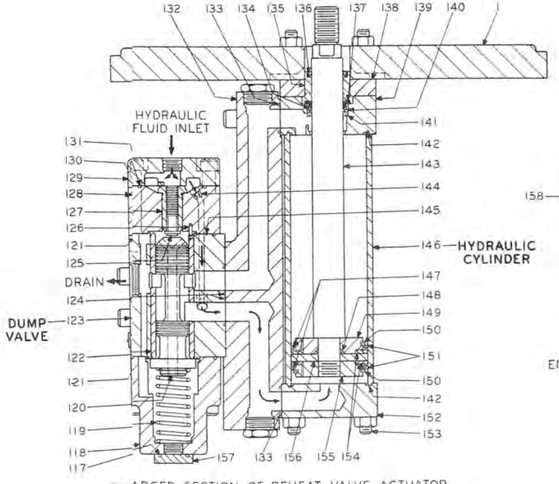
CITY OF HASTINGS 1/13

413 4253

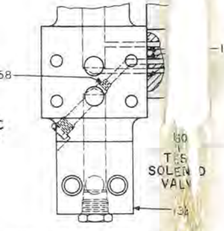
1 PLATE
2 CONNECTOR
3 ADAPTER
4 LEVER
5 SPLIT BUSHING
6 SPRING RETAINER
7 VALVE STEM
8 GUARD
9 SPRING
10 WASHER
11 REFLECTOR
12 JACKING BOLT
13 JAM NUT
14 NUT
15 PULLDOWN RING
16 GASKET
17 VALVE STEM GUIDE
18 VALVE BODY
19 BUSHING
20 PIN
21 PIN
22 BUSHING
23 REHEAT STOP VALVE
24 SPLIT BUSHING
25 VALVE COVER
26 BUSHING
27 VALVE SEAT
28 INTERCEPT VALVE
29 VALVE
30 SPLIT BUSHING
31 CAP
32 VALVE COVER
33 PIN
34 STRAINER
35 STEM SEAL
36 VALVE GUIDE
37 PIN
38 GASKET
39 PIN
40 UPPER GUIDE
41 VALVE STEM
42 JAM NUT
43 CROSSHEAD
44 SHIM
45 BEARING CUP
46 LIFTING PIN
47 BRACKET
48 PIN
49 CUP SEAT
50 COVER
51 SPLIT RING
52 BEARING – DU
53 WASHER
54 PIN
55 LEVER
56 PIN
57 BEARING CAP
58 BEARING
59 WASHER
60 BEARING – DU
61 PIN
62 CLEVIS
63 JAM NUT
64 PULLDOWN ROD
65 STUD
66 BOLT
67 JAM NUT
68 COVER
69 CONNECTOR
70 CLEVIS
71 SPRING SEAT
72 PIN
73 GUARD
74 STEM
75 GUIDE
76 SPRING
77 SPRING
78 PACKING
79 COVER
80 BUSHING
81 SPRING SEAT
82 STEM GUIDE
83 BOLT
84 DOWEL
85 FLANGE
86 CONNECTOR
87 STUD
88 ROD END
89 ARM
90 STUD
91 COUPLING
92 GUARD
93 VALVE
94 SPACER
95 TRANSDUCER
96 BRACKET
97 BRACKET
98 BRACKET
99 PIN
100 LINK
101 ROD END
102 INDICATOR
103 BRACKET
104 SPRING DOWEL
105 LINK
106 INDICATOR
107 STUD
108 BLOCK

109 ARM
110 SPRING (DOWEL
111 PIN
112 COVER
113 BEARING – DU
114 VALVE SEAT
115 SPACER
116 BRACKET
117 O-RING
118 CAP
119 SPRING
120 SPOOL
121 O-RING
122 SLEEVE
123 BODY
124 O-RING
125 PISTON
126 PIN
127 BUSHING
128 CAP SCREW
129 CAP
130 HEAD
131 O-RING
132 MANIFOLD
133 O-RING
134 ROD PRESSURE RING
135 BUSHING
136 WIPER
137 ROD SEAL
138 SQUARE RETAINER
139 HEAD
140 ROD WAVE SPRING
141 INNER BUSHING
142 CYLINDER SEAL
143 PISTON ROD
144 ORIFICE
145 O-RING
146 CYLINDER
147 PISTON WAVE SPRING
148 FOLLOWER SEAL
149 PLAIN FOLLOWER
150 PISTON PRESSURE RING RETAINER
151 PISTON PRESSURE RING
152 CAP
153 TIE ROD
154 CUP SEAL
155 THREADED FOLLOWER
156 PISTON
157 PLUG
158 ORIFICE
159 O-RING

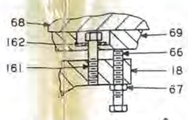
160 SOLENOID VALVE
161 BOLT
162 WASHER
163 O-RING
164 CAP
165 CYLINDER SEAL
166 CYLINDER
167 O-RING
168 PISTON WAVE SPRING
169 PISTON
170 FOLLOWER SEAL
171 THREADED FOLLOWER
172 PRESSURE RING RETAINER
173 CUP SEAL
174 PISTON PRESSURE RING
175 PLAIN FOLLOWER
176 INNER BUSHING
177 HEAD
178 ROD PRESSURE RING
179 SQUARE RETAINER
180 ROD SEAL
181 BUSHING
182 WIPER
183 PISTON ROD
184 TIE ROD
185 ROD WAVE SPRING
186 MANIFOLD
187 SPRING CAP
188 O-RING
189 SPRING
190 SLEEVE
191 SPOOL
192 BODY
193 PISTON
194 O-RING
195 BUSHING
196 HEAD
197 CAP
198 PIN
199 O-RING
200 ORIFICE
201 O-RING
202 SERVOVALVE
203 ADAPTER
204 O-RING
205 ORIFICE
206 O-RING
207 MOUNTING PLATE
208 SERVOVALVE
209 ADAPTER
210 O-RING

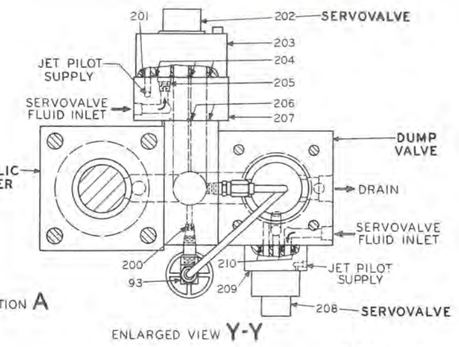


ENLARGED SECTION OF REHEAT VALVE ACTUATOR
FLOW ARROWS IN DIRECTION TO OPEN VALVE

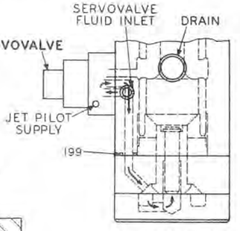


ENLARGED VIEW IN DIRECTION OF ARROW X


ENLARGED SECTION A



ENLARGED VIEW Y-Y



ENLARGED VIEW IN DIRECTION OF ARROW Z

ENLARGED SECTION OF INTERCEPT VALVE ACTUATOR
FLOW ARROWS IN DIRECTION TO OPEN VALVE

REHEAT STOP VALVE
AND
INTERCEPT VALVE
2132154

STUD, BOLT AND JOINT TIGHTENING

STUD AND BOLT TIGHTENING

The Stretch Data for Tightening Studs and Bolts Table tabulates the stretch required for tightening each size stud and bolt. It also shows the number of flats and fraction of a flat that the nut or bolt must be turned after hand tightening to produce the stretch. Stretch is determined by measuring the length of the stud or bolt with a micrometer before and after tightening. The difference in length is the amount of stretch. Hand tight is defined as that tightness which is necessary to pull the assembled parts together but beyond which results in stretching the stud. Corresponding torque values for smaller bolt diameters not listed in the table are furnished in Fig. 1.

For studs or bolts one inch in diameter or larger, pre-torqueing is required to ensure accurate tightening stresses. The proper pre-torqueing values are furnished in the following table.

Bolt Size-Dia	Pre-torque Moment or Equivalent
1 inch to 1 3/8 inch	100 ft lbs or one man pulling a one foot wrench
1 1/2 inch and larger	100 ft lbs per inch or one man pulling on a wrench with a handle increasing in length at a rate of one foot per one inch of bolt size

NOTE: No pre-torqueing is necessary for tightening bolts and studs which have a diameter of less than one inch.

HOT TIGHTENING

Studs 2 inches or more in diamter on steam joints are drilled for gas heating in preparation for tightening. During heating, the nuts are tightened until the required stretch has been produced in the stud. From the Stretch Data for Tightening Studs and Bolts Table, note that a one-nut stud 2 inches in diameter and 11 inches long having 8 threads per inch should be stretched 0.012 inch which is approximately equivalent to one flat of tightening. One flat on the nut and an adjacent surface on the flange should be marked, as shown at A and B in the sketch. The stud should be heated and the nut tightened until the marks coincide.

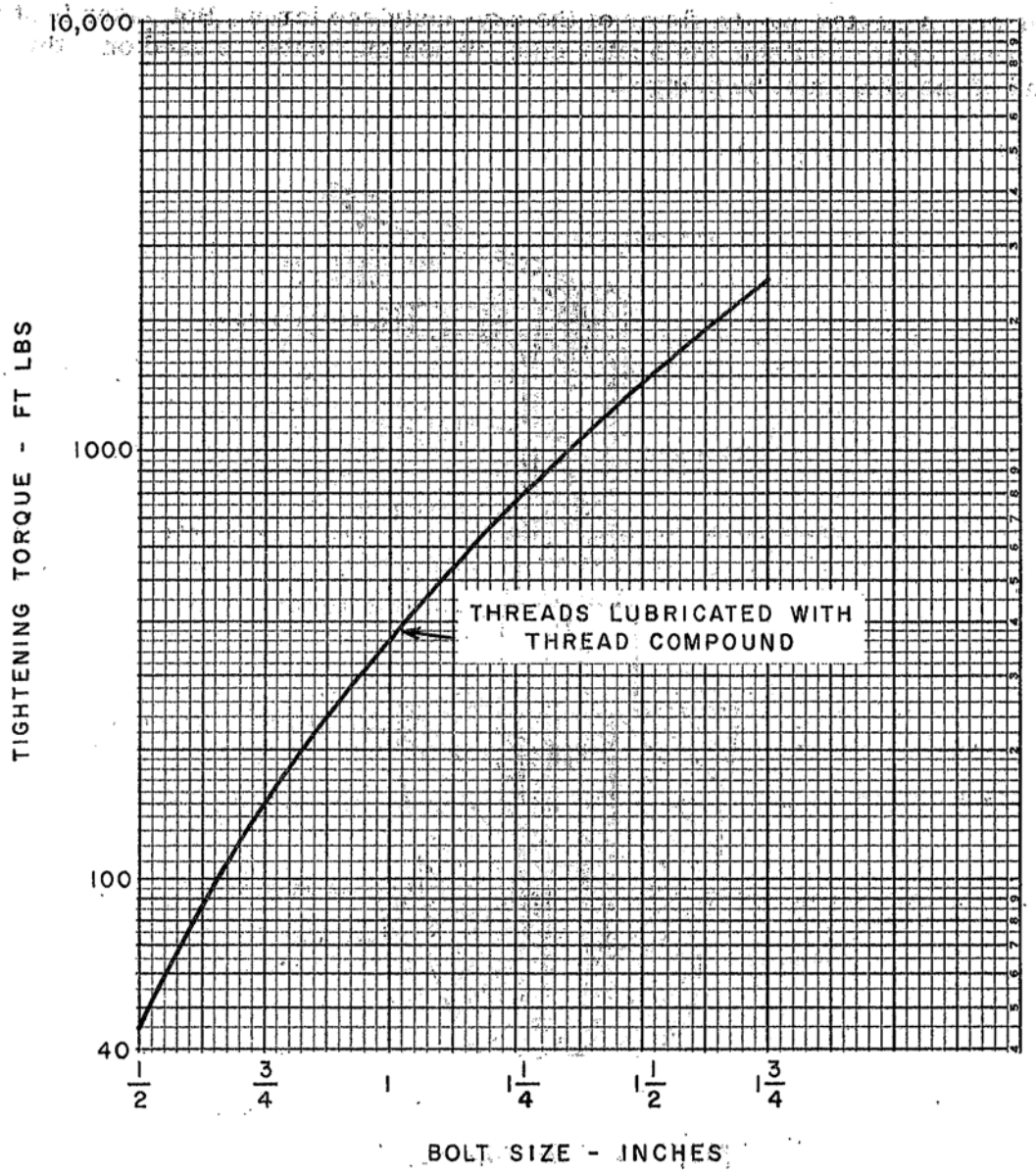


Fig. 1 - Bolt torque curve

Gas Heating the Studs

The hot-gas stud heater supplied, Fig. 2 is used with an oxy-acetylene torch for heating bottoming studs and through studs. The heater is designed for use with 1/4 and 3/8-inch pipe extensions for stud-heating holes of 5/8 and 7/8-inch diameters.

Compressed air is heated by the flame of the oxy-acetylene torch. Hot gases heat the stud and exhaust upward outside the heater pipe. When the heater is used on a through stud, one end of the stud must be plugged.

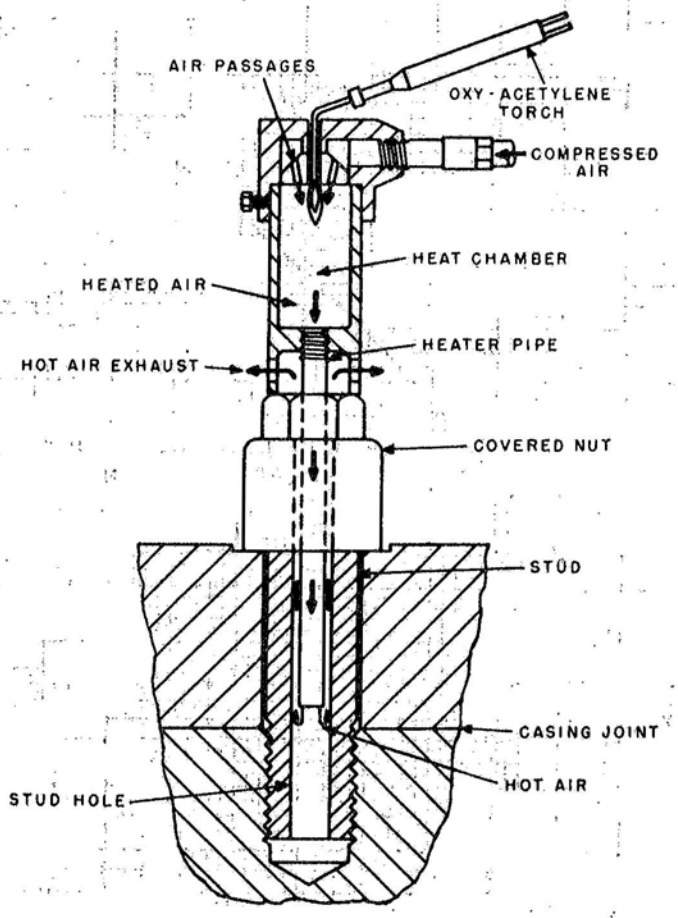


Fig. 2 - Stud heating

WARNING: Observe all safety precautions when using the oxy-acetylene torch. Check all gas lines for leaks and ventilate the area to prevent the formation of hazardous gas pockets.

If the heater is used as recommended below, uniform heating will be obtained and an inexpensive carbon-steel heater pipe can be used.

With the stud supporting the heater, the length of the pipe extension should be from 70 to 90 percent of the over-all length of the stud. When the pipe extension is longer than the stud, cut a V-notch in the end of the pipe to prevent the flow of heated air at the bottom of the stud from being shut off.

1. With the heater in position, start the flow of compressed air before applying the torch.

> CAUTION: Do not substitute oxygen for the compressed air. To do so will cause an oxygen-rich mixture.

2. Set a No. 6 Victor weld tip (#36 drill size) for complete combustion to obtain the most efficient heating from the oxy-acetylene flame. Avoid too rich a mixture to prevent excessive tip heating.

3. Insert the torch tip so that the tip end (or flame) extends beyond the air holes in the heater cap.

4. Adjust the air flow (or flame) as required to bring the heater pipe to the desired temperature.

> NOTE: When the heater pipe (as observed through the vent holes) glows cherry red (1050 F), the temperature of the heated air leaving the chamber will be very near the correct temperature.

With uniform heating, elongation of the stud will be complete in from $7\frac{1}{2}$ to 10 minutes. During this time, stud temperature will rise approximately 300 F, and the temperature of the heater pipe will stabilize at 1050 F.

Tighten the nut periodically during the heating operation until the recommended number of flats has been turned.

TIGHTENING JOINTS

When tightening joints, use the following procedure:

1. Slug up all the nuts starting in the center of the joint and work alternately from side to side toward both ends. This is to ensure closure of the joint.

2. Return to starting point, loosen nuts one at a time and pre-torque following the same sequence as in step 1.

3. After pre-torqueing, tighten the nuts according to both the sequence in step 1, and the values in Fig. 1 or in the Stretch Data for Tightening Studs and Bolts Table.

FOUR-WAY JOINT TIGHTENING PROCEDURE

1. Butt the two bottom halves together and tighten the lower three nuts leaving the vertical joint open 0.003 to .005 inch at the horizontal joint. Rotate one part until the extreme ends of the step at the horizontal joint are within ±0.001 inch. Pre-torque nuts one inch and larger starting at the bottom nuts and working alternately from side to side up to the horizontal joint. Repeat process until pre-torqueing values repeat within 5 per cent. Finish tightening by applying torque values in Fig. 1 for bolts under one inch or by turning number of flats stated in tables for bolts over one inch. Note: This may require hot tightening.

2. Lower the top halves onto the bottom halves and butt the bottoms of the top halves together. Install locating dowels in the horizontal joint at this time. Pre-torque nuts on vertical joint until values repeat within 5 per cent. To pre-torque, start at the top nuts and work alternately from side to side down to the horizontal joint.

3. Pre-torque the horizontal joint by starting at the mating faces closest to the four-way joint and by working alternately from side to side toward the ends.

4. Finish tightening vertical joint using same sequence as in step 2.

5. Finish tightening horizontal joint using same sequence as in step 3.

HOW TO ORDER REPLACEMENT PARTS

ORDERING DATA

When ordering replacement parts for equipment manufactured by the General Electric Company, give the following data:

1. Name of the purchaser.

2. Complete address to which shipment of parts is to be made.

3. Serial number as given on the nameplate. If parts are ordered for each machine in a set (such as turbine, generator, and exciter), give the serial number of each machine.

4. Complete rating of the machine as given on the nameplate.

5. Drawing number, including group (G) or part (P) number, as determined from the drawings and parts lists on microfilm aperture cards furnished to the purchaser and the General Electric District Office.

6. Give each part an item number. For example: Item 1, one set of first-row, first-stage buckets.

7. Send the order to the nearest General Electric Company Sales Office.

If there is a proposed change from original design in the steam conditions under which the turbine is to operate, furnish full information as to initial pressure, superheat, and exhaust pressure.

Parts which form one complete working unit must be ordered together; that is, valves and seats, shafts or pins and bushings, etc. Both halves of a bearing will be furnished.

Bucket bands are furnished unpunched. Unless otherwise specified, a punch and die will be included in shipment of replacement buckets. Bands are always sent with buckets.

If the part ordered has been superseded by a later design, the newer part will be furnished unless the purchaser specifies an exact duplication.

Unless specifically covered by instructions to the contrary, bolts and dowels will be included with the parts ordered.

In supplying a new governor, or rebuilding an old governor, the original adjustments, within reasonable limits, will be duplicated unless instructions are received to the contrary. If a different speed setting or regulation is desired, this must be clearly specified in the order.

Overspeed governors will be furnished adjusted to the original tripping speed, unless specifically ordered otherwise.

Concerning replacement parts for the controlling mechanism of machines of older design, the various safety features now available and considered necessary will be incorporated.

Inspect all parts upon receipt and prepare them for storage. Slush all finished iron or steel surfaces with oil or compound to protect them from corrosion. Be sure to remove all slushing compound when installing parts, especially those contacting the turbine oil system.

> NOTE: Replacement parts for equipment manufactured by companies other than General Electric Company, West Lynn, Mass. U.S.A., should be ordered directly from the manufacturer whose nameplate is on the equipment. When ordering, be sure to identify the part wanted, and include the model and serial number from the nameplate.

SHIPPING INSTRUCTIONS

Before returning apparatus to the factory, consult the nearest General Electric District Office for shipping instructions. Unnecessary delays may be avoided if the apparatus is shipped directly to the factory where repairs will be made.

RETURNED APPARATUS TAGS may be obtained from the District Office.

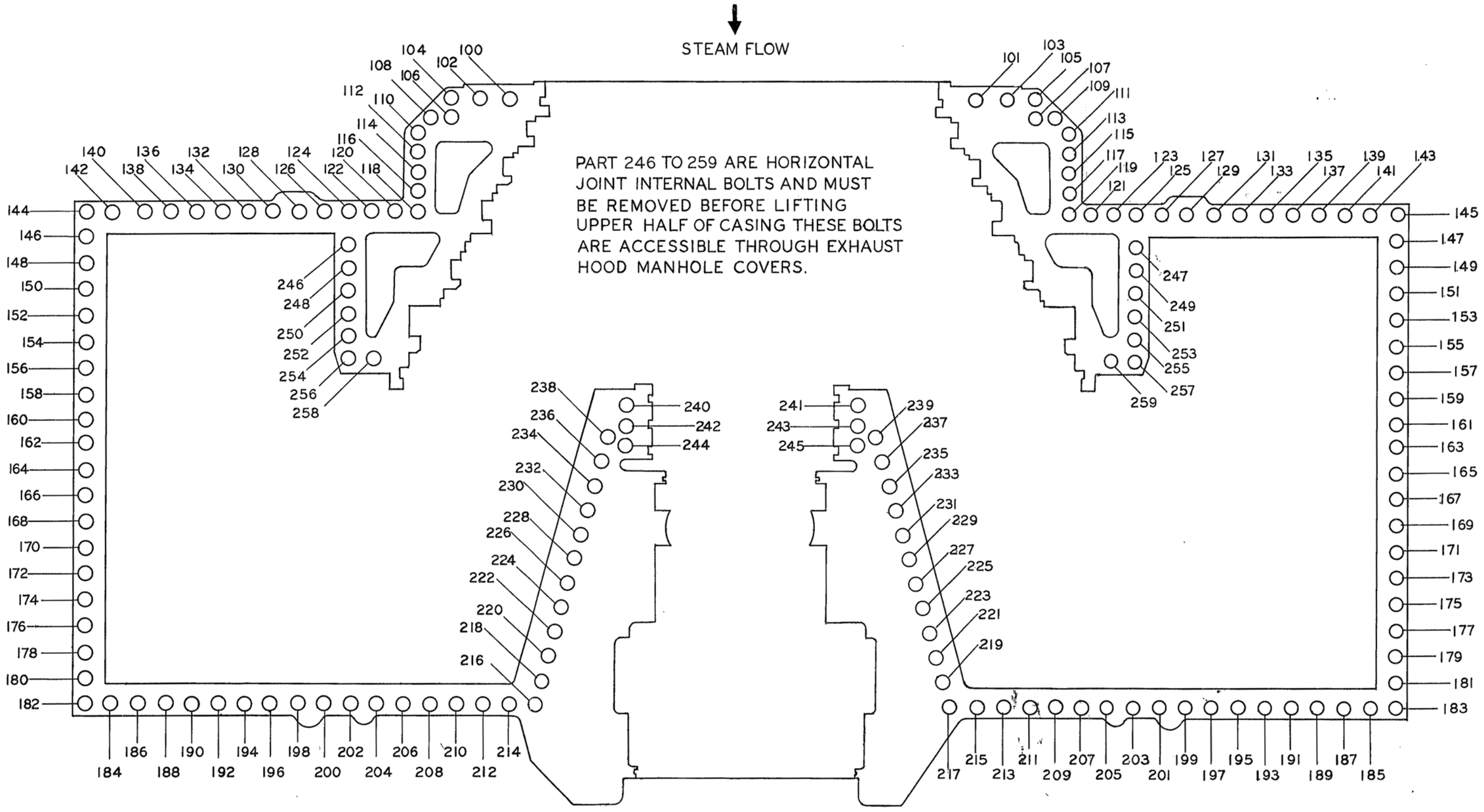
Return parts to the factories for repair or replacement according to the following instructions:

1. Where circumstances permit, a returned apparatus tag, properly filled in, should be enclosed in each box or attached to each large piece which may be shipped as a separate item. If returned apparatus tags cannot be obtained, securely attach identification tags to the various parts. On each tag, write the serial number of the turbine to which the part belongs.

2. When returning large parts, such as heavy castings, diaphragms, wheels, gears, etc., paint or stencil the names of the purchaser and part on each of these large pieces to facilitate quick identification.

3. Notify the factory promptly that such material is being forwarded. This notice should be at the factory before the arrival of the material.

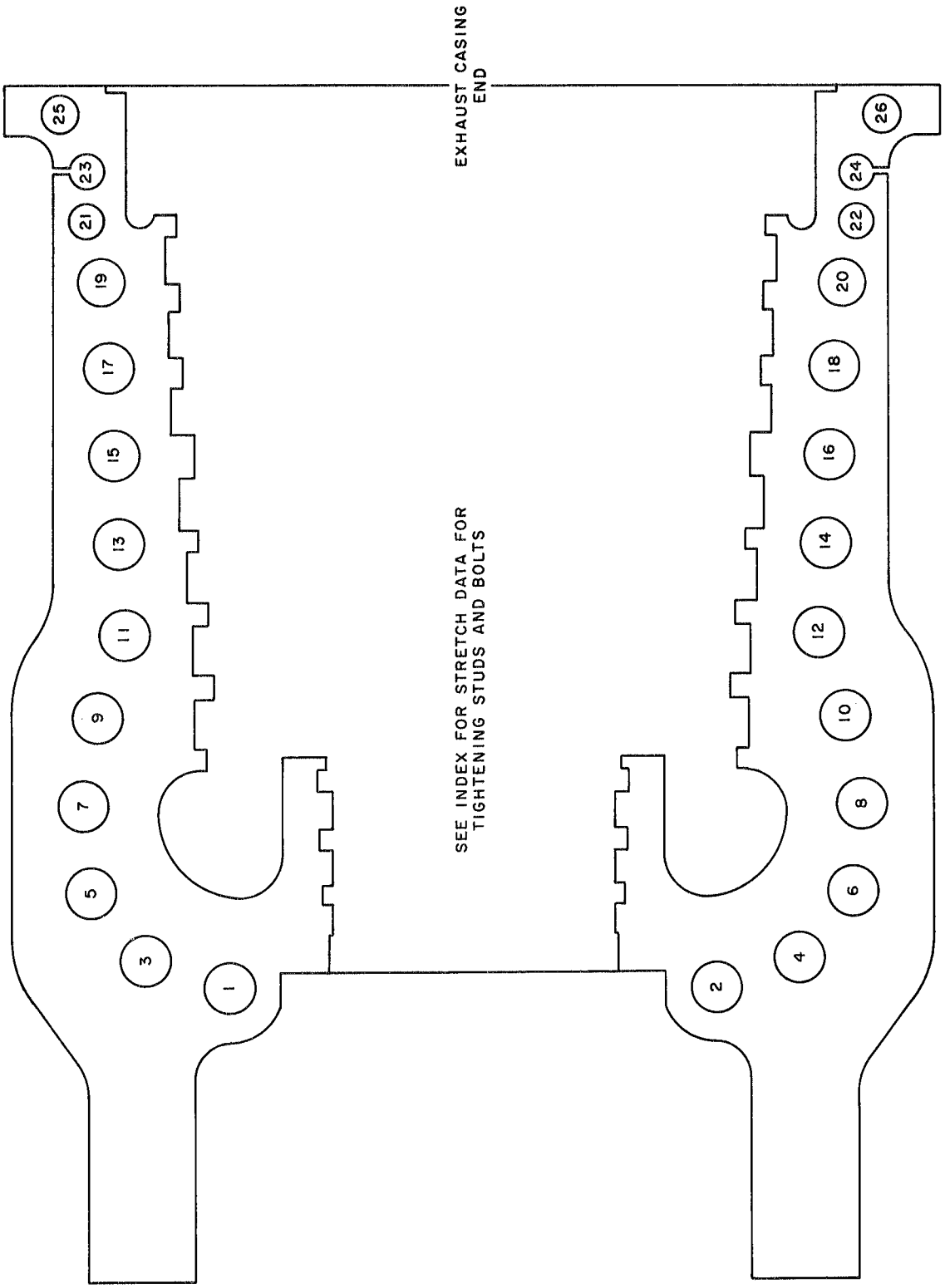
4. The method of shipment (car number and routing, if carload shipment is made) should be stated, and the various parts listed to facilitate checking for shortages, inspection of material returned, and preparations for repair.



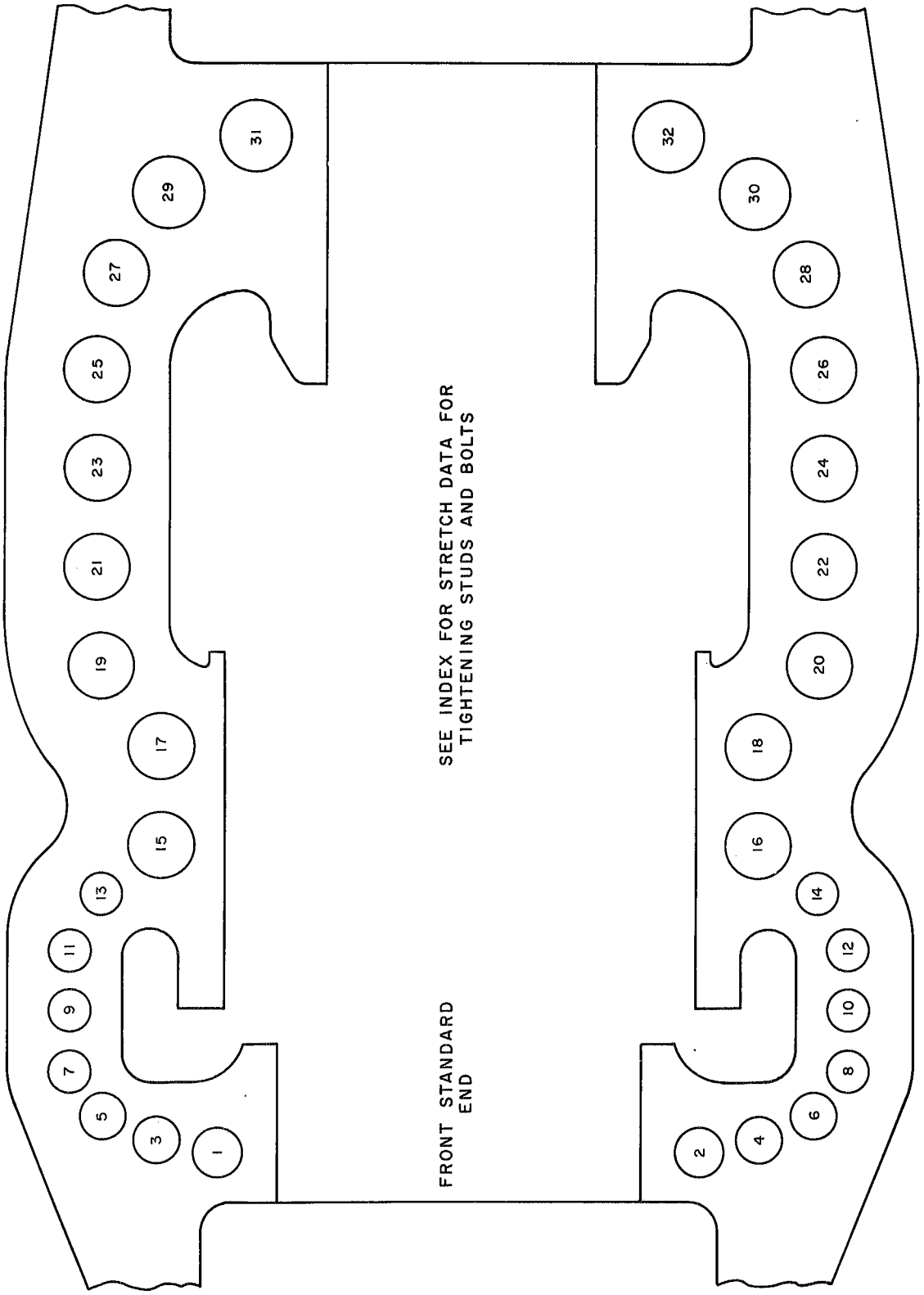
SEE INDEX FOR STRETCH DATA FOR TIGHTENING STUD AND BOLTS

HORIZONTAL JOINT BOLTING FOR EXHAUST CASING

2128132
(REV. 5-13-63)



HORIZONTAL JOINT BOLTING
REHEAT CASING
2130979



HORIZONTAL JOINT BOLTING FOR
HIGH PRESSURE HEAD

2130905

ONE NUT STUDS

OVERALL LENGTH OF STUDS		4–4 7/8		5–5 7/8		6–6 7/8		7–7 7/8		8–8 7/8		9–9 7/8		10–10 7/8		11–11 7/8		12–12 7/8		13–13 7/8		14–14 7/8		15–15 7/8		16–16 7/8		17–17 7/8		18–18 7/8		19–19 7/8		20–21 7/8		22–23 7/8		24–25 7/8		26–27 7/8		28–29 7/8		30–32 7/8		33–35 7/8		36–38 7/8		39–41 7/8		42–44 7/8		45–47 7/8	
NO. OF FLATS	STRETCH	FL.	STR.	FL.	STR	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.
STUD DIAMETER 8 PITCH	1, 1 1/8, 1 1/4, 1 3/8	3/8		1/2		5/8		3/4		1		1		1 1/8		1 1/8		1 1/4		1 1/4		1 3/8		1 1/2		1 1/2		1 1/2		1 5/8		1 3/4		1 7/8		2		2 1/8		2 1/4		2 3/8		2 5/8											
	1 1/2, 1 5/8, 1 3/4, 1 7/8	3/8		3/8		1/2		3/4		7/8		1		1		1 1/8		1 1/8		1 1/4		1 3/8		1 3/8		1 1/2		1 1/2		1 5/8		1 3/4		1 3/4		2		2 1/8		2 1/4		2 3/8		2 1/2											
	2, 2 1/4									7/8	.008	7/8	.009	1	.011	1	.012	1 1/8	.014	1 1/4	.015	1 1/4	.017	1 3/8	.018	1 1/2	.020	1 1/2	.021	1 5/8	.023	1 5/8	.024	1 3/4	.026	1 7/8	.029	2	.032	2 1/8	.035	2 1/4	.038	2 1/2	.042	2 3/4	.047	2 7/8	.051	3 1/8	.056	3 3/8	.060	3 5/8	.065
	2 1/2, 2 3/4, 3									7/8	.007	7/8	.008	1	.010	1	.011	1 1/8	.013	1 1/8	.014	1 1/4	.016	1 1/4	.017	1 3/8	.019	1 1/2	.020	1 1/2	.022	1 5/8	.023	1 5/8	.025	1 7/8	.028	2	.031	2 1/8	.034	2 1/4	.037	2 1/2	.041	2 3/4	.046	2 7/8	.050	3 1/8	.055	3 3/8	.059	3 1/2	.064
	3 1/2, 4									3/4	.006	7/8	.007	7/8	.009	1	.010	1	.012	1 1/8	.013	1 1/4	.015	1 1/4	.016	1 3/8	.018	1 3/8	.019	1 1/2	.021	1 1/2	.022	1 5/8	.024	1 3/4	.027	1 7/8	.030	2 1/8	.033	2 1/4	.036	2 3/8	.040	2 5/8	.045	2 7/8	.049	3 1/8	.054	3 1/4	.058	3 1/2	.063
	4 1/2, 5, 6									5/8	.004	3/4	.005	7/8	.007	7/8	.008	1	.010	1	.011	1 1/8	.013	1 1/8	.014	1 1/4	.016	1 1/4	.017	1 3/8	.019	1 1/2	.020	1 1/2	.022	1 5/8	.025	1 7/8	.028	2	.031	2 1/8	.034	2 1/4	.038	2 1/2	.043	2 3/4	.047	3	.052	3 1/8	.056	3 3/8	.061

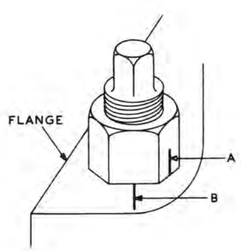
TWO NUT STUDS

OVERALL LENGTH OF STUDS		4–4 7/8		5–5 7/8		6–6 7/8		7–7 7/8		8–8 7/8		9–9 7/8		10–10 7/8		11–11 7/8		12–12 7/8		13–13 7/8		14–14 7/8		15–15 7/8		16–16 7/8		17–17 7/8		18–18 7/8		19–19 7/8		20–21 7/8		22–23 7/8		24–25 7/8		26–27 7/8		28–29 7/8		30–32 7/8		33–35 7/8		36–38 7/8		39–41 7/8		42–44 7/8		45–47 7/8	
NO. OF FLATS	STRETCH	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.	FL.	STR.
STUD DIAMETER 8 PITCH	1, 1 1/8, 1 1/4, 1 3/8	3/8		1/2		5/8		3/4		1		1		1 1/8		1 1/8		1 1/4		1 1/4		1 3/8		1 1/2		1 1/2		1 1/2		1 5/8		1 3/4		1 7/8		2		2 1/8		2 1/4		2 3/8		2 5/8											
	1 1/2, 1 5/8, 1 3/4, 1 7/8	3/8		3/8		1/2		3/4		7/8		1		1		1 1/8		1 1/8		1 1/4		1 3/8		1 3/8		1 1/2		1 1/2		1 5/8		1 3/4		1 3/4		2		2 1/8		2 1/4		2 3/8		2 1/2											
	2, 2 1/4									7/8	.009	1	.010	1	.012	1 1/8	.013	1 1/4	.015	1 1/4	.016	1 3/8	.018	1 3/8	.019	1 1/2	.021	1 1/2	.022	1 5/8	.024	1 5/8	.025	1 3/4	.027	1 7/8	.030	2 1/8	.033	2 1/4	.036	2 3/8	.039	2 1/2	.043	2 3/4	.048	3	.052	3 1/4	.057	3 3/8	.061	3 5/8	.065
	2 1/2, 2 3/4, 3									7/8	.008	7/8	.009	1	.011	1	.012	1 1/8	.014	1 1/4	.015	1 1/4	.017	1 3/8	.018	1 1/2	.020	1 1/2	.021	1 5/8	.023	1 5/8	.024	1 3/4	.026	1 7/8	.029	2	.032	2 1/8	.035	2 1/4	.038	2 1/2	.042	2 3/4	.047	2 7/8	.051	3 1/8	.056	3 3/8	.060	3 1/2	.064
	3 1/2, 4									7/8	.007	7/8	.008	1	.010	1	.011	1 1/8	.013	1 1/8	.014	1 1/4	.016	1 1/4	.017	1 3/8	.019	1 1/2	.020	1 1/2	.022	1 5/8	.023	1 5/8	.025	1 7/8	.028	2	.031	2 1/8	.034	2 1/4	.038	2 1/2	.042	2 3/4	.047	2 7/8	.050	3 1/8	.055	3 3/8	.060	3 1/2	.064
	4 1/2, 5, 6									3/4	.005	3/4	.006	7/8	.008	7/8	.009	1	.011	1	.012	1 1/8	.014	1 1/4	.015	1 1/4	.017	1 3/8	.018	1 1/2	.020	1 1/2	.021	1 5/8	.023	1 3/4	.026	1 7/8	.029	2	.032	2 1/8	.035	2 1/4	.038	2 1/2	.043	2 3/4	.048	3	.053	3 1/4	.057	3 3/8	.061

BOLT (HEX. OR SOCKET HEAD)

LENGTH UNDER HEAD		1–1 7/8		2–2 7/8		3–3 7/8		4–4 7/8		5–5 7/8		6–6 7/8		7–7 7/8	
NO. OF FLATS	DEGREES	FL.	DEG.	FL.	DEG.	FL.	DEG.	FL.	DEG.	FL.	DEG.	FL.	DEG.	FL.	DEG.
BOLT DIA.	3/4, 7/8	1/4	12°	1/4	17°	3/8	26°	1/2	34°	3/4	43°	7/8	52°	1	63°
NC & 8 PITCH	1, 1 1/8, 1 1/4, 1 1/2, 1 3/4	1/8	8°	1/4	12°	3/8	19°	1/2	26°	5/8	34°	3/4	41°	7/8	51°

NOTE: TOLERANCE ON STRETCH IS ±10% OR ±.002 WHICHEVER IS LESS



STRETCH DATA FOR
TIGHTENING STUDS & BOLTS
2124594
REVISED JULY, 1970

2007 DRILLING OUT BORE PLUG FOR BORESONIC INSPECTION

2007 CLEANING LP BORE

Boresonic Examination of the

Unit #1 LP Rotors

Hastings Utilities Whelan Energy Center

Hastings Nebraska 68091

Final Report

Prepared for
Power Generation Services, Inc.
2719 37th Street NW
Mandan, N.D. 58554

October 16, 2007

Prepared by	Timothy D. Febbie	Reviewed by	Robert Mullens
Signature	Timothy D. Febbie	Signature	Robert Mullens
Date	*October 16, 2007*	Date	10/17/07

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TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

This final report of October 16, 2007 details the technical attributes for the scope of services specified in accordance with P.O. number 1332.

NuVision Engineering, Inc. (NuVision) was contracted by Power Generation Services, Inc. to perform a rotor boresonic examination on the Low Pressure (LP) Rotor for Unit #1 Hastings Utilities, Whelan Energy Center Hastings, Nebraska. All inspections and related activities involving these rotors were performed on site at the Whelan Energy Center in Hastings, Nebraska on October 9 thru October 11, 2007.

Specially designed near-surface fixed focused ultrasonic probes increased flaw detection probability and sizing capability over that of many contact or immersion systems with or without the application of various signal processing, data reduction and/or clustering routines. This is due to specially designed NuVision fixed-focused probes which greatly enhance near-bore resolution in the critical first half inch of radial depth. Conventional, non-focused ultrasonic probes inspected the remaining radial distances up to six inches of metal path. Eddy current inspection was performed in lieu of the magnetic particle inspection method on the bore inner surface.

Characterization of some non-relevant reflectors was achieved with minimal alteration or adjustment of the acquired data through use of a comprehensive evaluation and analysis software program. Simple post processing procedures to remove artifacts and other non-relevant reflectors were applied to the raw data.

Results: LP

The ultrasonic examination of the LP rotor resulted in the identification of non-metallic inclusions and point reflectors in the first (6) six inches of the bore opening which was 3.037" in diameter. Nothing was linked up or in proximity to each other. Part of the examination detected sub-surface low amplitude signal indications likely attributable to inherent forging discontinuities. The as-found bore condition was lightly corroded and no surface breaking flaws were found by either Visual or ECT Inspection.

Recommendations

LP Rotor
Given the location and type of indications identified on the LP rotor (inherent forging discontinuities) as a result corrective action by way of repair by machining (over boring, bottle boring, localized material removal) is not recommended prior to returning the LP rotor to service. This area should be monitored at the next turbine overhaul.

II. SCOPE OF SERVICES

The boresonic examinations consisted of bore surface preparation (honing); visual examination (VT) of the bore surface; bore mapping/dimensional measurements; volumetric ultrasonic examination (UT); and surface eddy current examination (ET) on each rotor bore.

Personnel experienced in the application and analysis of high resolution UT and ET of rotor bores were provided by NuVision to perform the scope of services covered under the referenced purchase order.

Name	Responsibilities
Timothy D. Febbie	Project Manager/UT Level II/System Operator/Data Analyst
Harold Dumas	Equipment Operator

III. INSPECTION METHODOLOGY

A. Bore Access

The bore plug removal, fabrication and installation allowing NVE access to the bore opening was done by Uintah Machine & Mfg. Co..

B. Bore Surface Preparation

NuVision used a manually operated power honing process to remove surface imperfections such as rust, scale, and oxides. This operation provided the proper surface finish for the subsequent UT and ET inspections. Bore preparation was accomplished by progressing from coarse to finer grit honing stones.

C. Bore Visual Inspection

The VT system used by NuVision was specifically designed and built by InterTest for visual inspection of rotor bores. The system features a miniature video camera that transverses the bore, fiber optic light sources, an electronically focused lens, and a digital viewer/recorder. The pre-hone visual inspection of the turbine rotor bores was performed to assess the degree of honing required and to detect gross flaw and/or repair conditions.

The post-hone VT was conducted, upon completion of all honing operations, to document the surface condition of the bore including any detected flaws.

D. Dimensional Measurements

The dimensional system used by NuVision was specifically designed and built by InterTest for dimensional assessment of rotor bores. Design tolerance for measurement purposes was +/- 0.0001 with a potential measurement deviation of +\- 0.0009.

Pre-hone bore mapping was performed to determine the amount of honing required, as well as to identify areas possibly subjected to gross creep deformation. Post-hone bore mapping was conducted to obtain baseline measurements of the bore's diameter for comparison with subsequent inspection activities.

E. Eddy Current Bore Surface Inspection

The eddy current system used for the inspection of the turbine rotor bore was the ECT 48 multi frequency eddy current system manufactured by Eddy Current Technology (ECT) specifically for the imaging of eddy current signals. The special NuVision designed spring-loaded eddy current probe manufactured by NDT Engineering was housed in the boresonic scan head such that the eddy current inspection was performed concurrent with the boresonic inspection. Two frequencies (100 KHz and 200 KHz) were used for this inspection. Eddy current inspection was performed principally to detect surface-breaking discontinuities such as fatigue cracking.

F. Eddy Current Calibration

Calibration was performed to optimize discrimination of flaw signals while reducing, as far as practicable, non-relevant responses such as lift-off and probe wobble. A cracked calibration standard was used to set the amplitude and phase rotation responses as a vertical deflection, while probe wobble or lift-off was adjusted as a horizontal deflection.

G. Multiple Element Focused Transducer Examination System

The boresonic examination system is comprised of an AIS designed multi-channel data acquisition and imaging system in conjunction with NuVision designed multiple-element focused ultrasonic transducers. The system includes the motion controls, 8-channel pulser/receiver, digitizers, and peripherals including hard disc drives, graphics display terminals and CD writable drives for data archival storage. The multi-channel pulse-echo megapulser provides all of the conventional orthogonal ultrasonic display mode views of C-scan (azimuthal coordinate v. axial length), B-scan (azimuthal coordinate v. radial depth), A-scan (pulse transit-time/amplitude) and Polar plot or "donut map" (azimuthal coordinate v. radial depth displayed in an inside curve corrected format).

For this specific examination, the scan head consisted of three "forks" housing a total of six transducer elements and a two frequency ET probe. The UT transducers included clockwise (CW) and counter-clockwise (CCW) annular dual element 45° shear wave transducers (with each element of the array being supported by its own pulser/receiver), and CW and CCW single-element 60° shear wave transducers.

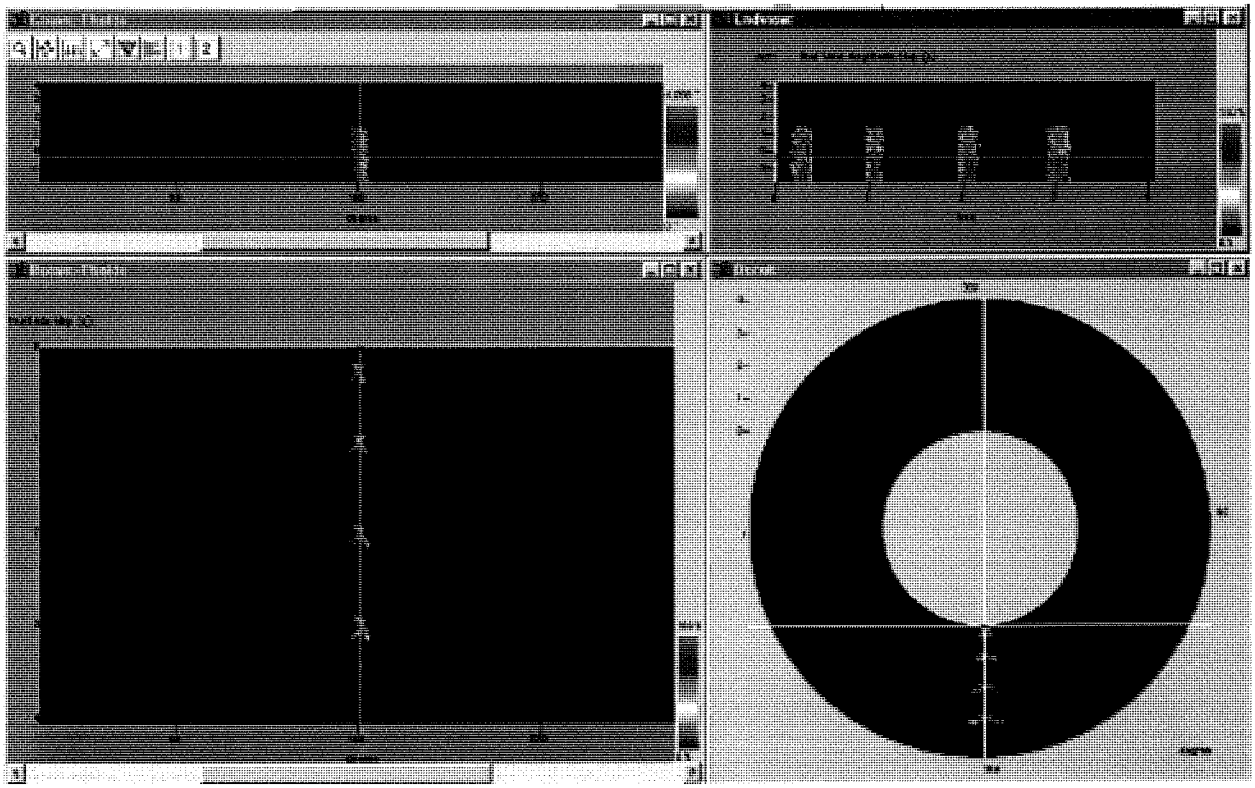
NuVision utilized the contact ultrasonic examination method in which the transducers are in continuous contact with the bore surface and couplant is automatically fed to the inspection surface. The scanner is coupled to the rotor flange face and the scans proceed in a reversing rotation raster pattern in which the search unit carriage is rotated a full 380°, indexed axially, and then reverse rotated a full 380°. Transducer contact was continuously monitored during the data collection. Axial scan increments of 0.100" were employed for the detection scans. Circumferential scan resolution was 0.3°.

Axially directed forward and aft shear wave examinations were not performed and is typically unnecessary for the detection of radial-axial flaw indications. This examination was not required in accordance with the referenced purchase order.

H. Boresonic Calibration

Calibration for examination was completed in accordance with NuVision procedure number 9905.0.018. An appropriate relative diameter calibration standard was used. The calibration standard contains four 0.062" flat bottom holes, one each oriented clockwise at 45° and 60°, and one each oriented counterclockwise at 45° and 60°. Four radially aligned side drilled hole reference reflectors ranging in depth from 0.250" to 3.0" are also machined into the calibration block, and are used to set up the DAC curves for each UT channel. Each of the six transducers The images on pages 6 & 7 represent a typical calibration used for boresonic examinations. Four radially positioned side-drilled holes are clearly evident in Figure 1. A typical calibration block drawing is shown Figure 2.

Figure 1
Block Calibration



Scan views from left to right are, Top row: C-Scan and End-view
Bottom row: B-Scan and Polar plot (donut map)

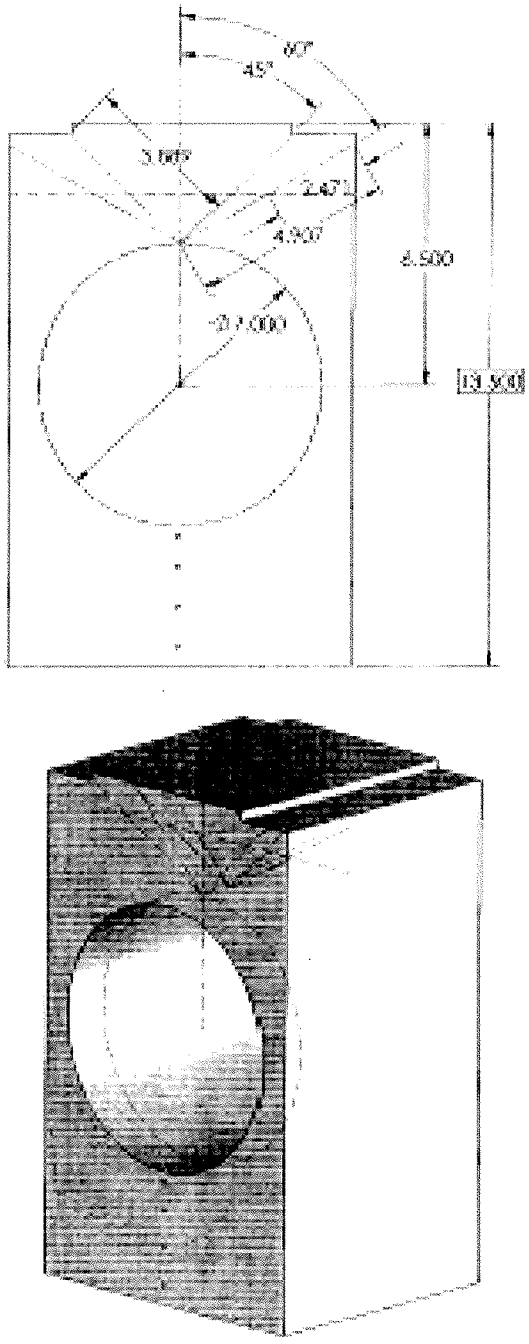


Figure 2 Typical Calibration Block

I. Boresonic Data Analysis

Non-relevant indications were readily identified and removed during the data analysis process. All reflectors not directly attributable to electronic or material noise, component geometry, or artifacts were analyzed to the extent that the analyst determined their shape, magnitude, and origin, if feasible.

Data analysis was performed utilizing the AIS multi-channel data acquisition and imaging system and the off-line analysis software utilizing the archived raw scan data. This program was used for reflector classification and discrimination to ensure accurate characterization and flaw indication measurements. Primary and secondary cursors are used to track/plot the R, Theta, Z coordinates of reflectors contained in the scan data.

J. Equipment

Provided below is a list of the equipment used during the course of this inspection:

AIS Multi-Channel Rotor Bore Data Acquisition and Imaging System
Two dual-element (0.300" & 0.500" dia.) 5 MHz, focused composite annular transducers
Two 0.500" diameters, 3.5 MHz, single element composite transducers
ECT 48 Multi Frequency Eddy Current System
NDT Engineering ET probe
Appropriate bore calibration blocks
Miscellaneous consumables

IV. SUMMARY OF RESULTS

Boresonic Inspection

No reportable indications were identified in the rotors surface or sub-surface. No further corrective action by way of repair by machining (over boring, bottle boring or localized material removal is not recommended prior to returning the HP/IP rotor to service.

Low Pressure (LP) Rotor

Dimensional Measurements

Dimensional measurements were initiated at the starting point of the plug bore and preceded down the rotor bore shaft at 2.0-inch intervals. All axial/down bore measurements were referenced from the turbine end coupling face. No apparent gross creep deformation was identified during this inspection. Pre and post hone dimensional readings are included in Appendix A of this report.

The LP rotor was found to contain a straight bore with no steps or bottling out. From the turbine end, the bore has a 3.037" diameter and approximately 83 5/8" in length to the bore plug.

Visual

A pre and post hone visual examination was conducted prior to and after honing. The pre-hone examination revealed a light corroded bore. No relevant or reportable indications were found during the pre or post hone visual examinations.

Eddy Current Inspection

No reportable indications were identified along the bore's length and accessible surfaces. Non-relevant indications associated with probe lift-off and wobble were recorded.

Boresonic Inspection

The six channel focused ultrasonic examination resulted in the identification of no significant flaw indications. The examination detected some sub-surface low amplitude signals indications likely attributable to inherent forging discontinuities in the first (6") six inches of the bore.

Given the type of indications identified on the LP rotor, corrective action by way of repair by machining (over boring, bottle boring or localized material removal) is not recommended prior to returning the LP rotor to service.

Artifacts and non-relevant reflectors were removed, if possible, during the data analysis processes. No scan limitations associated with the plug bore and non-access end were encountered during this inspection.

Warrants and Representations

This report represents the best engineering judgment of NuVision Engineering, Inc. relative to the scope of services provided and the results derived there from. The scope of services included only a nondestructive assessment of the surface and near-surface material of the rotor bore shaft in terms of the presence or absence of relevant flaw indications or conditions. Re-inspection interval recommendations and engineering condition assessments/remaining life estimation evaluations were NOT requested by the customer and; therefore, were not performed by NuVision. Consequently, neither NuVision nor any person acting on behalf of them:

(A) Makes any warranty or representation whatsoever, express or implied, (i) with respect to the use of any information, apparatus, method, process, or similar item disclosed in this report, including merchantability and fitness for a particular purpose, or (ii) that this report and its contents are suitable to the customer's circumstance; or

(B) Assumes responsibility for any damages or other liability whatsoever (including any consequential damages, even if NuVision or any of its representatives were advised of the possibility of such damages) resulting from your selection or use of this report or any information, apparatus, method, process, or similar item disclosed in this report.

APPENDIX A
DIMENSIONAL MEASUREMENTS

Boresonic Examination Data Sheet

Client:	Power Generation Services	Plant:	Hastings-Whelan	Drawing number:	4417.04.001
Location:	Hastings, Nebraska	Unit:	1	Bore Diameter:	3.022
Component:	LP Rotor	Rotor Length:	83 5/8"	Bottle End (Z):	N/A
Bottle Dia:	N/A	Bottle Start (Z):	N/A	Step End (Z):	N/A
Bore Step Dia:	N/A	Step Start (Z):	N/A	Bore step Dia. End	
Axial (Z) ref:	Male Rabit fit.	Examiner:	Timothy D. Febbie	Examiner:	
Circ (Ø) ref:	0 Degree Match Mark	Level:	II	Level:	

Axial Location (In)	Preliminary Bore Dimension	Final Bore Dimension	Bore Diameter Difference	Remarks
6	3.017	3.037	0.020	
8	3.015	3.030	0.015	
10	3.015	3.029	0.014	
12	3.00	3.025	0.025	
14	2.999	3.02	0.023	
16	2.995	3.017	0.022	
18	3.000	3.027	0.027	
20	2.996	3.019	0.023	
22	2.994	3.021	0.027	
24	2.992	3.025	0.033	
26	2.996	3.027	0.031	
28	2.993	3.027	0.034	
30	2.997	3.029	0.032	
32	2.997	3.028	0.031	
34	2.995	3.030	0.035	
36	2.997	3.032	0.035	
38	2.995	3.029	0.034	
40	2.997	3.029	0.032	
42	2.998	3.027	0.029	
44	2.998	3.027	0.029	
46	3.000	3.028	0.028	
48	2.997	3.029	0.032	
50	2.996	3.030	0.034	

Boresonic Examination Data Sheet

Client:	Power Generation Services	Plant:	Hastings-Whelan	Drawing number:	4417.04.001
Location:	Hastings, Nebraska	Unit:	1	Bore Diameter:	3.022
Component:	LP Rotor	Rotor Length:	83 5/8"	Bottle End (Z):	N/A
Bottle Dia:	N/A	Bottle Start (Z):	N/A	Step End (Z):	N/A
Bore Step Dia:	N/A	Step Start (Z):	N/A	Bore step Dia. End	
Axial (Z) ref:	Male Rabit fit.	Examiner:	Timothy D. Febbie	Examiner:	
Circ (Ø) ref:	0 Degree Match Mark	Level:	II	Level:	

Axial Location (In)	Preliminary Bore Dimension	Final Bore Dimension	Bore Diameter Difference	Remarks
52	2.996	3.031	0.035	
54	2.997	3.029	0.032	
56	2.997	3.027	0.030	
58	2.998	3.029	0.031	
60	2.998	3.03	0.032	
62	2.998	3.029	0.031	
64	2.998	3.028	0.030	
66	2.998	3.028	0.030	
68	2.998	3.029	0.031	
70	2.996	3.027	0.031	
72	2.998	3.030	0.032	
74	2.998	3.025	0.027	
76	2.998	3.027	0.029	
78	2.998	3.028	0.030	
80	3.000	3.029	0.029	
82	3.010	3.031	0.021	
84	3.000	3.025	0.025	
86	3.000	3.025	0.025	
88				
90				
92				
94				
96				
98				
100				

Boresonic Examination Data Sheet

Client:	Power Generation Services	Plant:	Hastings-Whelan	Drawing number:	4417.04.001
Location:	Hastings, Nebraska	Unit:	1	Bore Diameter:	3.022
Component:	LP Rotor	Rotor Length:	83 5/8"	Bottle End (Z):	N/A
Bottle Dia:	N/A	Bottle Start (Z):	N/A	Step End (Z):	N/A
Bore Step Dia:	N/A	Step Start (Z):	N/A	Bore step Dia. End	
Axial (Z) ref:	Male Rabit fit.	Examiner:	Timothy D. Febbie	Examiner:	
Circ (Ø) ref:	0 Degree Match Mark	Level:	II	Level:	

Axial Location (In)	Preliminary Bore Dimension	Final Bore Dimension	Bore Diameter Difference	Remarks
102				
104				
106				
108				
110				
112				
114				
116				
118				
120				
122				
MIN. READING	**2.994**	**3.021**		
MAX. READING	**3.017**	**3.031**		
AVERAGE	**3.005**	**3.026**		