Q. Please provide all reports of work completed under the 2012 Major Overall of Unit 1.

A. Hydro completed a major overhaul of the turbine generator in 2012. Please see DD-NLH-040 Attachment 1.

NALCOR Holyrood GS

Maintenance and Operational Improvements

NLH Contract 2011-47219

Alstom Contract
ES0-000326 / EE0-000399

Outage Reports 2012

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Power Service
an ISO 9001 / 14000 company
1430 Blair Place, Suite 600
Ottawa, Ontario, Canada
K1J 9N2

Turbine Generator Summary Report - 2012 Newfoundland & Labrador Hydro - Holyrood TGS

By

John Adams

ALSTOM Canada Inc.

Reference # Nalcor-Holyrood –STG- ES0-000326/399-01

REPORT DATA

Purpose of Visit:	2012 Turbine & Generator Site Support		
Customer:	NFLD & Labrador Hydro	ALSTOM Ref No.:	ESO-000326
Site Location:	Holyrood GS	Customer P.O.:	
ALSTOM PM:	Ghanshyam Patel	Start Date:	February 14, 2012
ALSTOM TSA:	John Adams	End Date:	October 3, 2012

EQUIPMENT INFORMATION – Unit 1 & 2

Equipment:	**Steam Turbine**
Equipment OEM:	Canadian GE
Serial No.:	940310
Type:	D6
Rating:	175 MW
Rated Speed:	3600 rpm
Rated Main Steam Pressure:	1800 psi
Rated Main Steam Temp:	1000 F
Rated RH Steam Pressure:	
Rated RH Temp:	1000 F
Rated Condenser Pressure:	1.7 in Hg A
Rated Condenser Temp:	
Control System:	GE MkV

Equipment:	**Generator**
Equipment OEM:	Canadian GE
Serial No.:	980485
Type:	
Rating:	194,445 kVA
Frequency:	60 Hz
Speed:	3600 rpm
Stator Voltage:	16.0 kV
Stator Current:	7016 A
Field Voltage:	375 V
Field Current:	1864 A
Power Factor:	0.90
Cooling System:	Hydrogen
Connection:	Star

CONTACT INFORMATION

ALSTOM PM:	A.K.Sengupta	Cust Contact 1:	Paul Woodford
Phone	905-333-2036	Email:	pwoodford@nlh.nl.ca
ALSTOM TSA:	John Adams	Phone (bus):	709-229-2140
Phone	709-229-2143	Phone (cel):	
		Fax:	709-229-7894

1 Executive Summary

This report summarizes the work done by Alstom Power & Transport Canada in 2012 for Newfoundland and Labrador Hydro (NLH) on the Holyrood Thermal Generating Station steam turbines, generators, and related equipment.

Table 1.1 below lists the technical reports that were created for NLH in 2012. The table also lists the Tab # in this report where the technical report can be found.

This document summarizes the technical information presented in the reports listed below. Also, this document provides additional information not found in the technical reports, including safety and environmental performance, lessons learned, and information regarding post-outage unit start-up.

Table 1.1 – Work Completed and List of Technical Reports

Unit	Description of Work	Time Period	Report Reference	Tab #
All	Environment Health and Safety Report			2
1	Major overhaul of steam turbine and generator	May 21 to Aug 10	FSRG015121	3
1	Generator Diagnostics	June 13 to 16	CFRG 015595	4
1	Generator Bump Test	June 7 to 12	FSRG015977	5
1	Generator RSO Testing – Full Speed No Load	May 1 to May 5	S481/12/054B	6
1	Generator Engineering Recommendations	Sept 26	UTGE672107	7
2	NRV Rework and Generator Open and Close	Sept 17 to Oct 3		8
2	Generator RSO Testing – Full Speed No Load	May 1 to May 5	S481/12/053A	9
2	Generator DIRIS Inspection	Sept 19 to 22		10
3	On-Line testing of Load Limit Control Issues	Feb 14 to Feb 15	PAL 12-1465	11
3	Repair of Speed Relay Component (Load Limit Issue)	Aug 7 to Aug 8	Record Sheet	12

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2 Safety and Environmental Performance

The report attached in Tab 1 of the Appendix discusses the Environmental Health and Safety (EHS) performance of the work done by Alstom at Holyrood in 2012. The report includes safety results and statistics and a discussion of safety and environmental initiatives.

During the year there was no lost time or medical treatment accidents. There were four minor first aids and one near miss incident.

3 Recommendations – Unit 1

For convenience, the following lists of recommendations are compiled from all of the technical reports issued during 2012. For more details and clarifications and for recommendations regarding the other two Holyrood units, please refer to the referenced report.

Steam Turbine

Recommendation	Reference Report
Replace HP inner and outer cylinder bolting next major outage	FSRG015121
Replace upper half snout rings at next major outage	FSRG015121
Replace all steam packing HP/IP/LP	FSRG015121
Replace all gland steam packing N1, N2, N3, N4, N5	FSRG015121
Replace steam packing springs and retainers	FSRG015121

Generator

Recommendation	Reference Report
Replace broken RTD in stator at re-wind outage	UTGE672107
Inspect belly bands at back of core at re-wind outage	UTGE672107
Perform core loop test during re-wind outage	UTGE672107
Replace hydrogen seals both ends during re-wind outage	UTGE672107
Replace inner oil deflectors both ends during re-wind outage	UTGE672107
Replace shaft grounding device with direct contact braided strap	UTGE672107
Perform initial electrical tests of rotor (megger, PI, pole balance) – re-wind outage	UTGE672107
Remove retaining rings – re-wind outage	UTGE672107
Visually inspect rotor end windings – re-wind outage	UTGE672107
PT inspect retaining rings – re-wind outage	UTGE672107
Electrical tests after retaining ring removal (3 step voltage, pole balance, RSO) – re-wind outage	UTGE672107
Re-install retaining rings with new insulation – re-wind outage	UTGE672107
Electrical test after ring installation (megger, pole balance) – re-wind outage	UTGE672107
Final electrical test (RSO) – re-wind outage	UTGE672107

Valves

Recommendation	Reference Report
Replace all inventory parts used	FSRG015121
Drill out studs on MS valve and RH valve covers and replace with new	FSRG015121
Replace all nuts on MS valve and RH valve covers	FSRG015121
Replace all NRV actuator springs	FSRG015121
Monitor NRVs for proper operation - PM	FSRG015121
Monitor water content in air supply to NRV actuators - PM	FSRG015121
Restore proper gap between MS valve cover and valve body	FSRG015121

Auxiliary Equipment and Other

Recommendation	Reference Report
Replace impellers on both AC oil pumps next outage	FSRG015121
Inspect Cuno filters and full flow filters per OEM Specifications	FSRG015121

4 Unit 1 Major Overhaul

4.1 Introduction and Scope

In general, the scope of this work was to complete a major overhaul of the Unit 1 turbine and Generator in accordance with the terms of the Turbine maintenance contract between NLH and Alstom. This included a complete overhaul of the turbine valves. Details of the work scope were determined in a planning meeting held at site on November 22, 2011.

Three factors had a strong influence on the scope of work.

1. The future of steam at the Holyrood plant is likely limited to five to seven years due to plans to develop the lower Churchill hydro project.

2. The Stage 1 generators may be modified to function in a convertible synchronous condenser mode of operation.

3. The current plan is to rewind the stator in 2015.

The last major overhaul of this turbine and generator was in 2003 and was performed by GE. In 2009 there was a valve outage performed by GE. At that time, the machine was opened to replace the nozzle block based on boroscope inspection and a previous failure on Unit 2.

4.2 Schedule

Twelve weeks of outage time were allowed for completion of the work. The scheduled period was from May 21 to August 10. One week of non-permit time was added before the outage for mobilization and also after for de-mobilization. The work was completed on schedule, utilizing five days per week and ten hours per day. Some additional days were worked to maintain schedule as required. There was no nightshift except during the lube oil flush when 24 hour supervision was provided.

4.3 Safety & Environment

Safety results and initiatives are discussed in the safety report attached in the appendix.

4.4 Summary

The outage work was completed on schedule and under the estimated costs. All planned work was completed. There were no major findings with the turbine or generator and no significant repairs required to any rotating components. Arco Industries did the blast cleaning of the rotor and diaphragms and Team Industrial (working directly for NLH) completed wet fluorescent magnetic particle inspections of the cleaned components.

Some unplanned work was completed. The most significant jobs are described below:

1. NRV 101 valve body was found to be cracked and was replaced with a new valve body that had been originally ordered for Unit 2. Two Pipefitter welders were hired to complete this job under permit applied for and issued by the Provincial Jurisdiction. The boiler inspector, Mr. Travis Rideout, completed the inspection and accepted the work.

2. The stem leak-off from the main stop valve was found to be loose at the threaded connection to the valve body. This section of pipe was removed and replaced. The work required one pressure part socket weld. A pipefitter welder was hired to complete this work under permit from the provincial jurisdiction. The boiler inspector, Mr. Travis Rideout, completed the inspection and accepted the work. Also related to this job, a 1-1/2" safety relief valve on this leak-off line was found damaged and was replaced with an identical valve.

3. Ontech Machining from Ancaster, Ontario was hired at the end of the outage to grind the collector rings. They had been found to be significantly out of round.

4. Plant Mechanic, Wayne Hawco, completed detailed measurements of the coupling, spacing, Collector End shaft flange, and other important dimensions that would be required to design a new thrust bearing arrangement for future conversion to synchronous condenser operation. Alstom has provided a proposal to NLH to complete an Engineering Study of the technical feasibility of such a conversion.

The outage results were documented in several technical reports as listed in Table 1.1 of this report. These reports are attached in the appendix.

4.5 Return to Service

The unit was started up without any need for balance or for a Commissioning Engineer. There were a couple of issues however that are discussed below. It was determined that these issues were not related to the work done by Alstom.

Hydrogen Leak

While preparing the unit for start-up a hydrogen leak was discovered. Testing identified a belly door and a hydrogen cooler gasket that were leaking. These were repaired by Alstom. When the unit was started-up a couple of days later, it was found that the leak had not improved and the unit had to be taken off-line after just a few days of operation. The leak was then found in a leak-off line flange and repaired by the plant.

This issue has identified problems with how the plant procedure for air leakage testing is being followed. A test was not completed to full pressure prior to gassing. The test done after the first repair was accepted although the leakage rate criteria were not met. Also, deficiencies in the method of hydrogen leak detection were identified.

Intercept Valves

When the unit was first on-line it was noted that the intercept valves were only indicating about 82% open on the Mark V. This was adjusted by plant Instrumentation to read 100% to allow for valve testing.

After making the adjustment, the plant attempted to test the valves and when the left hand valve closed during the first test, the unit lost about 30MW. Further testing was suspended pending investigation.

Intercept valve testing was attempted again several days later with the load reduced and all valves carefully monitored. Two problems were discovered. The LVDT were not reading correctly, and the scram signal was crossed with the opposite intercept valve such that the wrong valve was scramming shut.

Both issues appeared to be related to the Mark V control system. At the time of writing this report, the unit remained in service and plans were being made to investigate and resolve the Mark V issues.

4.6 Recommendations

Recommendations are summarized in Section 3 of this report. Details can be found in the technical report attached in the appendix.

5 Unit 1 and Unit 2 RSO Testing

5.1 Summary

Alstom was hired by NLH to perform RSO (Re-current Surge Oscillograph) testing of the Unit 1 and Unit 2 generator field windings. These tests were done from Full Speed No Load (FSNL) down to turning gear speed by David Smith. Insulation Resistance (IR) tests were also performed at turning gear speed. Technical reports are attached in the appendix.

Plant Electricians were responsible for preparing and installing insulated test brushes (two per ring). Tests were started at FSNL. The turbine was then tripped and testing continued as the speed decayed to turning gear speed and centrifugal forces on the windings reduced.

There were several issues that delayed the testing. First, test brushes had to be prepared and installed. Also there was a plant safety meeting on the first day that delayed the start of work. When trying to run-up Unit 1, the unit tripped on vibration. Number 1 bearing in axial was worst but Number 2 also was high. This was an operational problem that was eventually resolved. Also an entire day was lost due to burner electrical problems on Unit 1. As a result of these issues, the Technician was asked to change his return flight to remain an extra day and complete the testing. Fortunately, late in the final day, the testing was completed on Unit 1.

Test results were favourable. For Unit 2, the measurements recorded showed no indications of any inter turn faults in the windings. For Unit 1, the measurements showed very minor indications of an inter turn fault, but the levels were within the Alstom specifications.

For both generators, the IR testing revealed no issues with respect to the rotor windings and rotor body (ground).

Information on generator monitoring options available from Alstom was included in the reports.

5.2 Schedule

The testing was done from May 1 to May 4, 2012. Day shift only.

5.3 Safety & Environment

There were no safety or environmental issues.

5.4 Recommendations

Recommendations are included in the technical reports attached in the appendix, and are summarized in Section 3 of this report.

6 Unit 2 Non-Return Valves

6.1 Summary

Details of this work are discussed in the technical report attached in the appendix.

During the 2011 Unit 2 valve outage, many of the non-return valves (NRVs) were found to be in poor condition internally. These included the three 8” valves (101, 102, 103) and the two 12” valves (104A, 104B). Parts were not available to complete the repairs at that time. These parts were ordered and delivered to site for installation at the next opportunity. Parts to be replaced included the discs, tail-links, and anti-rotation pins.

The work was completed as planned. All valves received new discs. All valves except 104A received a new tail-link. When parts were ordered, one 12” tail-link was missed. However, the re-used link was in reasonably good condition. All valves were lapped until satisfactory blue checks were attained. For the 102 valve, lapping took several days. This valve body was scheduled for replacement but the valve body ordered was used to replace NRV 101 on Unit 1, which had a serious crack. All other recommended work from 2011 has now been completed.

6.2 Schedule

The work was from September 17 to October 2, 50 hours per week. and was done in parallel with the Unit 2 generator open and close work (See Section 7 of this report).

6.3 Safety & Environment

Safety results and initiatives are discussed in the safety report attached in the appendix.

6.4 Recommendations

Recommendations are detailed in the technical report attached in the appendix.

7 Unit 2 Generator Open and Close – DIRIS Testing

7.1 Introduction and Scope

Open and Close details, and DIRIS results are included in the respective technical reports attached in the Appendix.

The generator was opened sufficient for Alstom to perform a rotor in-situ core inspection (DIRIS) and to perform measurements of the stator windings. This work was done to support the planned stator re-wind in 2014. The access required for both activities was essentially the same. Both required that the upperhalf endshields be removed from both ends to expose the end windings and air gap. The DIRIS inspection also required removal of the fan blades and air gap baffles and removal of the front standard cover to allow rotation of the field. Alstom provided the measurement personnel at no cost to NLH.

There were some findings that required extra work to correct as discussed below.

The rotor shaft was contacting the collector end (CE) oil deflectors and grounded. The rotor jack had to be installed on the CE to allow the DIRIS inspection to proceed. This delayed the DIRIS test. Also, to correct the problem, the lower half components, including the bearing, had to be removed and adjusted.

Other extra work included re-setting the main output cylinder that was noted to be stuck in the full open (over extended) position. Also, the #5 bearing was found in very poor condition with heavy scoring and electrolysis damage. This was cleaned up and PT of the babbitt was done by TEAM Industrial. There were no dowels in the CE hydrogen seal and two had to be made up from spare non-conducting material at a local machine shop. Also the outer oil deflector on the CE was bolt bound and the bolts had to be machined to eliminate this problem.

7.2 Schedule

The work was from September 17 to October 2, 50 hours per week. and was done in parallel with the Unit 2 NRV work (See Section 6 of this report).

7.3 Safety & Environment

There were no safety or environmental incidents.

7.4 Recommendations

Recommendations are detailed in the technical report attached in the appendix.

7.5 Photos

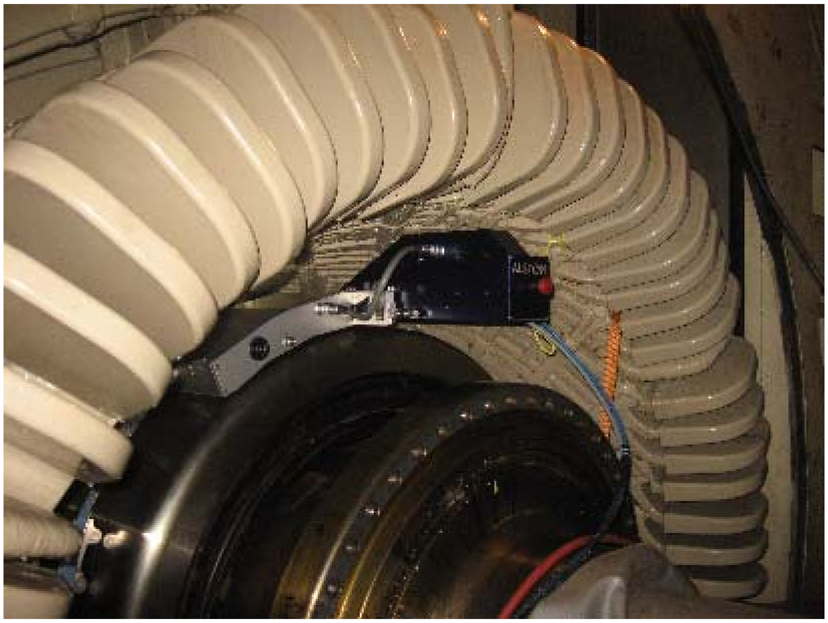

Figure 8.1 DIRIS Unit Installed on Generator

Figure 8.2 DIRIS Unit Installed in Air Gap

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Power and Transport Canada

8 Unit 3 On-line Testing of Load Limit Control Issue

8.1 Summary

Details of this work can be found in the technical report in the Appendix.

The purpose of the work was to investigate the long reported problem of load sticking and jumping during load changes while in load limit operation. Alstom first became involved in this problem in November of 2011 with the unit off-line. Testing was conducted with the unit on-line to better understand and quantify the problem.

Load was varied between 150MW (full load) and 110MW. Data collected included the load limit position (%), control valve cylinder position (%), speed relay movement (from dial indicator), control valve cam shaft angle, control valve opening and closing oil pressures (from temporary gauges installed by plant I&C department), and control valve 3 movement (using vernier calipers).

Non-linear repeatable load jumps between 120 and 140MW were noted while increasing and decreasing load. Dead-bands were also noted where changes in the load limit position did not result in load changes. Variations in the opening and closing oil pressures were interesting and possibly indicated binding in the control valve gear.

At the problem range, the #3 control valve is just beginning to re-open and is consequently in a steep portion of the valve curve. This would tend to magnify any irregularities from the control devices.

8.2 Schedule

The testing work was performed on February 14 to 16, 2012.

8.3 Safety & Environment

There were no safety or environmental incidents.

8.4 Recommendations

Recommendations are detailed in the technical report attached in the appendix.

9 Unit 3 – Repair of Speed Relay

9.1 Summary

The record sheet attached in the appendix contains the detailed information of the measurements and repair.

During an inspection of the speed relay in November 2011, it was observed that the cylinder and bushings were damaged. There was scoring and circumferential damage to the cylinder wall and the piston and bushing were worn and scored. Parts were ordered at that time and arrived on site in July. Rather than waiting until the next outage, Alstom requested and were granted a short outage on this unit to complete this work.

This repair was part of an ongoing effort to investigate and correct a problem that occurs when Operations are changing load on this unit. They experience dead bands and load jumps – particulary around 120MW. On-line testing was also done this year. Refer to Section 8 of this report.

The speed relay was removed. The cylinder was scratched inside and also had a 0.001" taper. It was honed to remove the taper and the scratching. The piston was scored and the shaft bushing was excessively worn. These parts were replaced with new parts that were ordered oversized and machined locally to match the new cylinder diameter.

9.2 Schedule

The work started on August 7th and was completed on August 8th. Work was done in parallel with the Unit 1 major overhaul.

9.3 Safety & Environment

There were no safety or environmental incidents.

9.4 Recommendations

There were no new recommendations. The work on the speed relay is complete.

9.5 Photos

Figure 10.1 Shaft Bushing Worn

Figure 10.2 Scoring and wear of piston

10 Miscellaneous Work – Proposals, Studies, RFI, etc....

The following is a summary of significant correspondence between Holyrood and Alstom during 2012 including proposals, studies, and requests for information.

- Proposal for Engineering Study on Synchronous condenser conversion – submitted August 23
- Proposal for Flux Probe – submitted April 3
- Pre-qualification tender for Stage 1 Stator Rewinds – submitted May 16
- RFI – virtual synchronous generators – requested May 25 and June 28
- Customer interested in upgrading Stage 1 governor – MkV no longer supported. Also Bently Nevada System. E-mail from Bob Garland on August 20
- Proposal for AMODIS ROMON II shaft grounding and monitoring system – submitted October 19

11 Appendices - Technical Reports

The following technical reports were issued during 2012.

ALSTOM Power Service
an ISO 9001 / 14000 company
1430 Blair Place, Suite 600
Ottawa, Ontario, Canada
K1J 9N2

Turbine Generator Environment Health and Safety Report - 2012
Newfoundland & Labrador Hydro - Holyrood TGS

By

John Adams

ALSTOM Power and Transport Canada Inc.

Reference: Nalcor-Holyrood –STG- ES0-000326/399-02

1 Executive Summary

This report summarizes the environment, health and safety (EHS) results of the work done by Alstom Power & Transport Canada in 2012 for Newfoundland and Labrador Hydro (NLH) on the Holyrood Thermal Generating Station steam turbines, generators, and related equipment.

There were no lost time accidents or medical treatment cases. There was one near miss and four first aids.

2 Safety Performance

This section discusses the Safety performance for the year as well as any improvements made.

Table 2.1 below is the most current copy of the monthly safety stats report that is prepared for NLH in accordance with our existing contract. Note that the site hours includes all Alstom employees working at site, craft labour, and subcontractors.

Table 2.1: Worksheet L - Safety Statistics for 2012

newfoundland labrador hydro
a nalcor energy company

Worksheet L

CONTRACT SAFETY STATISTICS - MONTHLY REPORT
September, 2012

Contract No:	2011-47219		Year:	2012		Report Date:	Oct. 23, 2012	
Contractor:	Alstom Power and Transport Canada							
	MONTHLY				CUMULATIVE FOR YEAR			
Month	Hours Worked	Disabling and Medical Aid Injuries	Disabling Injuries	Near Misses	Hours Worked	Disabling and Medical Aid Injuries	Disabling Injuries	Near Misses
January	151	0	0	0	151	0	0	0
February	113	0	0	0	264	0	0	0
March	142	0	0	0	406	0	0	0
April	327.5	0	0	0	733.5	0	0	0
May	2662	0	0	0	3395.5	0	0	0
June	8134	0	0	0	11529.5	0	0	0
July	5660	0	0	1	17189.5	0	0	1
August	2848.5	0	0	0	20,038	0	0	1
September	1528.5	0	0	0	21,566.5	0	0	1
October								
November								
December								
TO DATE TOTALS	21,566.5	0	0	1	21,566.5	0	0	1

2.1 Near Miss

Observation

The near miss incident had the potential for being serious. It occurred during the major overhaul of Unit 1. A prybar was dropped on the 3rd floor. It passed through the 3rd floor grating and fell to the ground floor. The prybar was being used as a temporary handle for a portable hydraulic lift device, owned by the plant. When the lift device was moved, the prybar slipped off the device and through the grating.

Corrective Action

After the incident, the missing handle was replaced properly to eliminate the need for the prybar. Alstom normally will wrap a ring of tape around the shaft of all prybars so that they cannot pass through floor grating and also attach rope for tie-off. This bar had not been wrapped. After the incident, all prybars were inspected and taped as required.

Observation

There was a second near miss that occurred during the Unit 2 NRV re-work. This was not included in the Alstom statistics because the incident was caused by another contractor. A scaffold that had been erected by another contractor close to our work area came in contact with a live light socket. The scaffold was also in contact with pipe insulation. Our crew noted arcing between one of our trouble lights and the pipe insulation cladding.

Corrective Action

This was reported to the plant Electricians, who investigated and corrected the problem.

2.2 First Aid

The worksheet above does not include first aid. There were four first aid incidents, all of which occurred during the major overhaul of Unit 1. Fortunately they were all minor. Table 2.2 below summarizes these incidents.

Table 2.2 Summary of First Aid Incidents

Date	Incident	Result	Analysis
May 30	Carrying metal cabinet when hand pinched between cabinet and a handrail	Bruise on hand	Gloves were being worn. Keep mind on task
May 30	Cutting lock wire with cutters. Loose piece of wire flicked up and struck nose	Small puncture wound on nose	Safety glasses were being worn. Use face shield for wire cutting
July 6	Employee experienced a hernia as a result of previous abdominal surgery	Employee became weak and vomited	Pre-existing condition
July 23	Wrench slipped while tightening nut on lube oil cooler	Small cut on knuckle	Gloves were not being worn. Wear proper PPE. Keep mind on task

The July 6 incident was actually a flare-up of a pre-existing medical condition (hernia) and not a result of anything that happened at work. Two members of the plant ERT team responded to this event and did an outstanding job in taking care of our employee. They monitored his medical condition and made him feel secure. Fortunately the hernia corrected itself after approximately 20 minutes.

Of the other three first aids, two were hand injuries. One occurred when the wrench that an employee was using slipped. This resulted in a small cut on the employee's knuckle. The other hand injury was a pinch that occurred when employees were carrying a metal storage cabinet. This resulted in a bruised hand. In both of these cases the root cause was considered to be that the employee was not paying sufficient attention to the task at hand. However, in the case of the slipped wrench, had the employee been wearing appropriate gloves there likely would not have been any injury.

The fourth first aid happened when an employee was cutting a piece of lock-wire with wire cutters. The cut piece of wire flicked upwards and struck the employee in the nose, piercing the skin. The most significant risk in this incident would have been an eye injury. The employee had been wearing his safety glasses at the time of the incident, which was the required PPE. Had the employee been wearing a face shield then the injury would have been prevented. This was discussed with the crew and they were asked to use face shields for future wire cutting.

2.3 Proactive Initiatives

A Proactive Hazard report was issued regarding pipes on grating used to support slings below. One of these pipes was bumped by a push cart and this could have caused the pipe to move and allow the sling to fall. If possible, a better method of attaching slings must be used. If not, then the pipe must be carefully secured and not in a location where it could become a hazard.

Alstom managed all aspects of confined space entry including issuing permits, gas testing, bump testing of gas monitors, and attendants. Rescue coverage was provided by the plant ERT Technicians. This included high angle rescue coverage for our crane operator.

Alstom participated in the NLH Safe Work Observation Program (SWOP). Through the year about 30 SWOPs had been submitted. As well, employees submitted more than 200 Alstom observation cards. Where warranted, these were converted to SWOPs.

Alstom utilized scaffold wherever possible to provide secure work areas for employees. This included inside the LP hood, for improved access to the NRVs below the turbine, and a work platform with handrails all the way around the lower half of the turbine.

Prior to starting work, Alstom requested that the lifting beam be MPI inspected at the lifting points to be used. Several cracks were found and were repaired. The beam was sent off-site for load testing and was MPI inspected again. Also inspected was the “eyebrow” support bracket for the generator rotor. One of the threaded rods associated with this tool had a linear indication and was rejected. Because this was an OEM supplied tool and no drawings were provided, Alstom Engineering was asked to re-design a rod to replace the defective one.

3 Environmental Performance

There were no negative environmental impacts. However there was one spill of lube oil. This occurred when the rental high velocity flushing pump skid was started up for the first time in preparation for the lube oil flush. The re-circulation hose from the pump skid back to the lube oil tank was not sufficiently secured inside the tank. It sprang free and sprayed oil in the general area. It was estimated that approximately 3 to 5 gallons of oil was spilled before the pump was shut down. Several Alstom employees in the area and two NLH employees were struck by oil spray. Little or no oil reached any drains. It was all cleaned up by Alstom employees. The spill was reported to NLH Environmental Manager, who determined that this was not a reportable incident.

Although not required for any spill, the Alstom spill kit was deployed as a preventative measure during the lube oil/seal oil flush. The detraining tanks on the second floor were flushed down to oil drums placed on the first floor. The spill kit was set up around these drums as a precautionary measure, but it was not needed.

ALSTOM

# Field Service Report (FSR)	Related CFSR issued ☐ Y ☒ N	Total pages without enclosures	Total pages enclosures
Report No. **FSRG015121**		40	8

Location	Department	Author	Date	Page No.
US	Thermal Services	Robert M Scott	10.08.2012	1

Site Information

Customer Newfoundland And Labrador Hydro	File Name FSRG015121_Overhaul_120810_Scott.pdf	
Site **HOLYROOD**	Country Name CANADA	PDM Event No.
Plant **HOLYROOD 1**	Plant Type FO	Outage code
Unit **HOLYROOD 1**	Service Ref No.	Order No.
System / Machine Steam Turbine	System / Machine Type 000	System / Machine Serial No. 000

Task Information

Business Case
Overhaul / C-Inspection

Task
Overhaul works

Task description

D6 Major Inspection

Distribution of FSR

Authors Distribution List				Official Distribution List			
Loc.	Dept.	Name	Notes	Loc.	Dept.	Name	Notes
				US	Thermal	Robert M Scott	
				US	Thermal	Paul R Nagle	
				US	Thermal	Robert Scott	

US	Thermal Services	Reviewed by Nathalie Muelhaupt	Date 10.08.2012
US	Thermal Services	Approved by Robert Scott	Date 29.10.2012
US	Thermal Services	Archived by Bianca K Figueroa	Date 30.10.2012

TABLE OF CONTENT

1. Summary

ALSTOM Power, Inc., was contracted by Newfoundland and Labrador Power Corporation (NALCOR) to provide engineering, project management, labor, and inspection services for the major inspection of the customer's unit 1 Turbine / Generator, S/N 0940310, located at the Holyrood Generating Station, Holyrood, NL.

The site was mobilized and the outage started on May 22, 2012, with a scheduled completion date of August 10, 2012. The inspection of this unit was performed on a one shift basis, 10 hours per day, 5 to 6 days per week, as necessary. In addition to the inspections of the turbine/generator and valves, ALSTOM Power supplied blast cleaning services and performed generator stator and field testing and steam path alignment services on the HP/IP and LP components. The hydraulic system was not part of this inspection and no work was performed on the hydraulic control system.

No major findings were noted during this inspection and the inspection was completed and the unit turned over to the customer on August 10, 2012, for return to service.

The generator and generator rotor inspection and testing was included in the generator specialist's report. Please refer to the specialist's report for findings and results of the testing and inspection.

The unit was put on turning gear on August 8th at 1430 hrs for grinding of the collector rings and the generator air test.

The collector rings were ground with the unit on turning gear by Ontech Machining, starting August 8th and completed on August 9th, to remove the out of roundness of the collector rings. The shaft grounding brush area was strap lapped to provide a better contact area. The proper tooling for grinding this area was not available.

The unit was released to the customer on August 10 and the writer was released. Final demobilization was completed August 17, 2012.

2. Summary internal

Nothing to report

3. Purpose and duration of assignment

Purpose of assignment	Arrival Date	Departure Date
Major Inspection of Unit Number 1 Turbine / Generator and Valves	17.05.2012	10.08.2012

4. Milestones

Nothing to report

5. Personnel involved

Unit		HOLYROOD 1					
No.	Name	Department	Code	Function	Position	Arrival Date	Departure Date
1	Robert M Scott	FSO	TFA	Technical Field Advisor	Lead	17.05.2012	10.08.2012
2	James George	FSO	TFA	Technical Field Advisor	Lead	22.05.2012	07.07.2012
3	Michael Holland	FSO	TFA	Technical Field Advisor	Lead	04.06.2012	03.08.2012
4	John Adams	Transport	SIM	Site Management Site Manager	Manager	14.05.2012	17.08.2012
5	Aldin Mclaughlin		SIA	Site Management Site Administrator	Manager	14.05.2012	17.08.2012
6	Sherry Moore-Hickey		SHS	Site Management Health & Safety Engineer	Manager	14.05.2012	17.08.2012

6. Operation data

Unit		HOLYROOD 1		
Type of data		Operation Data ST		
No.	Description	Unit	Reading / Value	Remarks
1	Date			Date of reading
2	Time			
3	OH	H		Operating Hour
4	EOH	H		Equivalent Operating Hour
5	TS	-		Total Starts
6	HS	-		Hot Starts
7	WS	-		Warm Starts
8	CS	-		Cold Starts
9	Trip	-		All unplanned trips
10	Trip High	-		Unplanned trips > 75% load
11	Last inspection date	-		Date of last inspection
12	Prod. Act. Power	MWh		

7. Technical information

Unit		HOLYROOD 1		
Type of data		Technical Information ST		
No.	Description	Unit	Reading / Value	Remarks
1	Type	-	MSTG	GE D-6 Unit
2	Serial No.	-	940310	
3	Rated Active Power	MW		
4	Rated Speed	rpm	3600	
5	Rated Main Steam Press.	psi	1800.00	
6	Rated Main Steam Temp.	F	1000.0	
7	Rated Reheat Pressure	psi		
8	Rated Reheat Temperature	F	1000.0	
9	Rated Condenser Pressure	psi	1.70	" HgA
10	Rated Condenser Temp.	F		or Rated Back Temperature
11	Control System	-	MKV	e.g. S90

8. Work carried out

8.1. Disassembly and Reassembly

The following is a record of the work performed during the disassembly, inspection, and assembly of the Unit 1 - GE D6 turbine/generator and valves located at Holyrood Generating Station.

8.1.1. Disassembly, Inspection and Reassembly of Steam Turbine

Alignment and couplings:

Prior to the disassembly of the LP/generator coupling, an as found coupling concentricity check was performed and found to be as left at the previous inspection, indicating there was no sign of slippage at the couplings.

The coupling was disassembled and separated for alignment checks. The generator was found to be as left in 2009, with Generator low 0.005" and sitting to the Right 0.004". The GE design alignment was for the generator to be 0.011” low and fair face. In reviewing with the customer, the unit has been running fine where it is, changing the alignment is not an option.

The coupling faces, coupling bolt holes, and coupling bolts were cleaned and inspected. They were found to be in good condition and returned to service.

At final assembly, the generator was found to be 0.005” low to the turbine, the face was open 0.001" at the top, and the generator was sitting to the right 0.004". The coupling was assembled and all bolting torqued to design. A final coupling concentricity check was made and found to be acceptable.

HP Outer and Inner Shells:

The HP outer shell was removed to the lay down area for cleaning and inspection. The HP shell was found to be in good condition, with evidence of grinding on the horizontal joint (previous outages) to remove indications. No additional grinding or repairs were required to the HP outer shell upper or lower half. The joint studs were cleaned and UT inspected in place. Stud number 40 was found to be cracked. ALSTOM ordered a new stud, nut, and tap and completed the replacement. ALSTOM was able to remove the stud by freezing the stud. Once the stud broke free, it was removed without difficulty. It should be noted, as in previous reports, that some of the joint studs are partially backed out and require spacers under the nuts. It was recommended that all the horizontal joint studs be replaced at the next major inspection.

The snout pipes, upper half, were cleaned and measured and found to be as left in 2009. No repairs were made or recommended at this time. The lower snout pipes were not inspected as the lower inner cylinder was not removed.

The HP inner cylinder upper half was removed to the lay down area and all diaphragms were removed. The HP inner cylinder was found to be in good condition with no repairs required or recommended at this time. The snout rings were found to be tight and were worked to free them up. The rings were measured and found to be as left in 2009. ALSTOM recommends that, at the next major inspection, the snout rings be removed and new snout rings machined and installed as clearances are approaching the maximum clearances. The lower snout rings were not inspected as the lower nozzle assembly was not removed. The inner cylinder bolting was UT inspected in place and found to be in good condition. ALSTOM recommends that all the inner cylinder horizontal joint bolting be replaced at the next major inspection.

The HP shell fits and diaphragm fits, upper and lower, were found to be in good condition with no repairs required.

At reassembly of the unit, the upper inner cylinder was reinstalled and all bolting was tightened and stretched to OEM specification. Unbolted joint gaps and bolted joint gaps were taken to assure joints were closed.

The outer shell was installed and all bolting was tightened and stretched per OEM specification. Unbolted joint gaps and bolted joint gaps were taken to assure shell joint was closed.

Centerline Line Key clearances

HP Shell Keys Front:	Left = 0.002" / Right = 0.002"
HP shell Keys Rear:	Left = 0.002" / Right = 0.002"
HP Circular Gib Keys Front:	Left = 0.008" / Right = 0.002"
HP Circular Gib Keys Rear:	Left = 0.006" / Right = 0.009"

Main Steam Inlet Flange gaps (Final):

TE gap = 0.314"

GE gap = 0.318"

L/S gap = 0.318"

R/S gap = 0.318"

IP Inner cylinders Number 1 and Number 2:

The upper inner cylinders were unbolted and removed to the lay down area and the diaphragms, upper and lower, were removed. The upper and lower cylinders were found to be in good condition and no repairs were required at this time. However, the upper cylinder bolt peening areas will need to be repaired at the next major inspection. This will require weld build up and machining to re-establish the peening lips.

The lower inner cylinders were not removed during this outage. All bolting was UT inspected and found to be in good condition. All diaphragm fits, upper and lower, and all shell fits are in good condition. No repairs were required.

At reassembly, the upper cylinders were installed and the bolts were tightened per OEM specification and locked in place.

LP Outer Hood and Inner Cylinder

The LP outer hood and inner cylinder were removed to the laydown area. The inner cylinder was flipped and all diaphragms were removed. The inner cylinder and outer hood were found to be in good condition and not repairs required. All vertical and horizontal joints were cleaned. There were four (4) crossover flange bolts that were drilled out and holes tapped. All inner cylinder upper and lower diaphragm fits were found to be in good condition. The horizontal joint of the inner cylinder had wash out that had been reported from previous outages and these were not repaired. All joint bolting was found to be in good condition.

At final assembly, the inner cylinder joint bolts were tightened to OEM specification and the outer hood joint bolts were tightened per OEM specification.

HP/IP/LP Turbine Rotor:

This unit is a three (3) bearing unit, with the LP bolted to the HP/IP rotor. The LP only has one bearing and as such, the LP remains bolted to the HP and removed in one piece.

Prior to removal of the turbine rotor, the rotor axial position was recorded and the rotor radial positions (oil bores) were recorded at the T1, T2, and T3 bearings, with shells on and shells off. Rotor thrust clearance was checked and found to be 0.013" as reported in 2009 inspection. There was 0.002" thrust cage movement in addition to the 0.013" float.

The turbine rotor was removed to rotor stands for blast cleaning by ARCO and NDE examination by the customers vendor (TEAM). There was evidence of previous FOD (Foreign Object Damage) that had been reported and repaired at the 2009 inspection. No further FOD was found on the three (3) flows, HP/IP/LP. No indications were found by NDE and no repairs were made to the rotating blades. The journals were scratched due to oil quality and were strapped to clean them up. The thrust runner was found in good condition and no repairs were required, other than Scotch Brite of the runner. No run outs on the rotor were recorded on the rotor at disassembly or assembly.

The rotor was cleaned and installed.

Steam Path Clearances and Alignment:

Prior to removal of the turbine rotor, radial and axial diaphragm and rotor clearances were taken and recorded. Clearances were within OEM tolerances and no re-positioning of the rotor (axial) was required.

Review of the steam path on disassembly, showed extremely light packing rubs, on the rotor in the N2 gland and IP section of the rotor. These were fresh rubs that have occurred from turning gear operation and during rolling of the turbine with weight off. All visual indications are that the steam path alignment is good and should not require any relocation of the diaphragms relative to the rotor.

Steam packing radial and axial clearances were taken and recorded. Clearances were consistent with the as assembled clearances from previous outages. While the radial clearances were slightly larger than design, the packing will be returned to service as has been done in previous outages. All packing segments will be cleaned and teeth sharpened prior to returning to service. Six new packing springs will need to be installed in packing rows 31 and 32.

ALSTOM Power contracted with Oasis to perform tops off and tops on laser tracking measurements of the HP/IP and LP turbine. The tops off check was with all lower half components installed (unit on half shell) and tops on was performed with the HP outer shell installed and tightened and the LP Inner cylinder installed and tightened. Once completed, the data was checked against the recommended GE laser alignment from 2003 and reviewed for corrections. The data compares favorably with the GE alignment data. The recorded oil bores by laser tracking did not compare favorably with the "as recorded" oil bores on disassembly or the "as recorded" oil bores from previous outages. When corrected, no diaphragm or gland moves are required. A re-check of the steam path by Oasis was not required. Spot checks of diaphragm position by ERAG will be completed as deemed necessary.

The rotor was reinstalled and set to position. Rotor axial and radial positions were taken and recorded. Rotor, diaphragm, and packing clearances were taken and recorded. Spot check of diaphragm positions were taken on stages 3, 7, 12, 15 and compared to as found and as left from previous outages and found to be good.

Bearings, Thrust and Oil Deflectors

T1, T2, T3, T4, and T5 bearings were removed from service; they were visually inspected, UT inspected, and measured for condition and clearances. The bottom half of all bearings showed a wear pattern consistent with turning gear operation and all bearings exhibited scratching indicating poor oil quality. The bearings were UT inspected and found to be in good condition. Measurements of the bearings showed all bearings were within specification and returned to service with Scotch Brite of the bores.

The bearings were reinstalled and at final assembly, the bearing twist and tilt was checked and corrected as required. Bearing pinch checks were taken and corrected as required. The T1 bearing was corrected to give slight pinch of 0.002". The T5 Bearing ring insulation was checked at disassembly and assembly and found to be good.

The thrust clearance was checked prior to disassembly of the thrust bearing and found to be 0.013” clearance and to have 0.002” float in the thrust cage. The thrust pads were removed, cleaned, UT inspected, checked for flatness, and found to be in good condition. A stack check of the thrust shows 0.013” clearance.

At reassembly of the thrust, the thrust cage was squared prior to installation of the pads. Final thrust bump was 0.013” with 0.002" float in the thrust cage.

Plant I&C disconnected all bearing instrumentation and reconnected at final assembly.

The oil deflectors T1 through T5 were removed from service, cleaned, assembled, and measured. All deflectors are slightly over-sized as they were when assembled in 2009. All deflector dimensions were reviewed with customer and agreed to return to service.

The oil deflectors were re-installed and the clearances set to 0.005”/0.006” on bottom and even side to side.

HP/IP and LP Diaphragms and Nozzle

The upper and lower diaphragms (HP/IP/LP) were removed from the unit, blast cleaned, and inspected, visually and by NDE. All diaphragms were found to be in good condition with no repairs required. Prior to removing the lower diaphragms, the “as found” diaphragm joint step checks, side slips, and axial crush pin clearances were checked and compared to the last outage. The side slips and axial crush pin clearances were acceptable and did not require additional repairs. Note: the clearances were slightly out of OEM recommended clearances but were acceptable.

The diaphragms were reinstalled in the unit and the as assembled diaphragm joint checks were taken to assure diaphragms were returned to the as found locations. No changes were made to the upper diaphragm elevations as the lower diaphragm elevations were not changed.

The upper and lower nozzle plates were not removed and were inspected in place. The first stage nozzle plates (upper and lower), were replaced in this unit in 2009 and were found to be in excellent condition – no thinning of the trailing edges, no signs of FOD, and no indications noted. All bolting was properly secured. No repairs required.

Diaphragm and Gland Packing Segments:

The diaphragm and gland (N1 – N5) segments were removed, cleaned, and visually inspected. The diaphragm and gland packing segments all have evidence of light rubbing in the lower half segments, as had been reported in the last two inspections (2003 and 2009). All packing will be returned to service.

The diaphragm and gland packing segment teeth were sharpened and reinstalled. A total of six (6) new packing springs were installed in rows 31 and 32.

Turning Gear and Front Standard:

The turning gear was not removed from service, but was inspected in place. The bearings and shafts were checked for excessive end play and movement and all were found to be good. The gear mesh was checked and found to be good. No excessive backlash or uneven gear engagement found. Chains were found to be in good condition and properly installed. The turning gear latch mechanism was found to be in good condition, no repairs required. The oil sprays were open and good.

The front standard guide rails were removed, the guides and rails were cleaned and lubricated, and the guides were reinstalled with the proper clearance between the guide and the rails. The front standard was lubricated.

Lube Oil tank / Pumps / Full Flow Filter System:

The lube oil tank was drained by the customer and cleaned out by ALSTOM. There was a layer of sludge in the bottom of the tank and indications were that there is a leak in the lube oil coolers.

The L.O. pumps were disconnected by the plant and the (2) AC motors and the (1) DC motor were removed and sent to the customer's shop for inspections and repairs. The L.O. pumps were disconnected in the oil tank and removed for inspection. The bearings and impellers on the (3) pumps were disassembled and inspected. The DC pump was found to be in good condition and no repairs were required. The bearings on the AC pump were found to be in need of replacement. The impellers on both AC were found to be cracked in the keyway. New impellers were ordered, but delays by the supplier prohibited the installation of the impellers at this outage. As a result, the oil impellers were repaired by cutting a new keyway 180 degrees from the existing keyway and then doing a weld repair to the old keyways in the areas of the cracks. The oil impellers were returned to service.

The AC motors and DC motor were refurbished by the customer’s vendor and reinstalled by ALSTOM once the pumps were installed in the tank. The customer re-wired the pumps.

The filters in the full flow filtration system were removed and inspected for cleanliness by ALSTOM Power. The South filters were tagged as replaced and ready for service Oct. 2003. These filters were out of service and do not appear to have been in operation at any time. The North filters were found to be in service and were fairly clean. New filters were installed in the North side after the oil flush.

The lube oil coolers were hydro tested and two leaks were found in the West cooler. The two tube were plugged. Following hydro testing, the coolers were removed and sent out for steam cleaning to remove deposits in the fins. Upon return, the coolers were reinstalled and each of the three tube bundles were pressure tested and found to be good. Water lines were restored and made ready for service.

The plant had a work order for the North check valve, as there is pressure decay once this pump is taken out of service. Removed the check valve cover and inspected the flapper to make sure it was seating properly. The flapper was found to be seating properly and had a good seal fit. The backside of the flapper showed evidence of "banging" against the top of the check valve when in the full open position and was most likely "hanging" up when in the full open position. The valve was "cleaned up" in the area of contact to try and reduce the probability of hanging open.

The lube oil tank was final cleaned by ALSTOM and inspected by the customer prior to final fill.

Oil Flush:

A system oil flush of the lube oil and seal oil system was performed. Prior to flushing, a meeting was held with the customer and the recommendation for supplying a separate pumping skid for flushing was approved. Pennecon supplied the flushing skid and ALSTOM operated.

Prior to flushing, the T4/T5 Bearing drain enlargement was drained, opened, and cleaned. Drain enlargement was extremely dirty and was flushed locally prior to start of flush. The gas side detraining tank was isolated and drained. The enlargement was also found extremely dirty and was flushed locally prior to start of flush.

The full flow filtration system filters were removed, the canisters were cleaned, and the filters were reinstalled for the flush.

The hydrogen seal oil unit filters (Cuno filters), East and West side, were removed for inspection and cleaning of the canisters prior to start of flush. The East side filters looked brand new and do not appear to have been run in the past. The West side filters were filthy – had the same residue as found in the H2 seal rings, springs, oil lines, and in the seal groove in the H2 seal casing. Spare Cuno filters were not in stock and customer has ordered them. The good filters were returned to service for the flush and the West side canister was closed without filters installed.

The hydrogen skid was bypassed for the flush as the tank had been drained and cleaned by the customer shortly after the unit was shut down for this outage. The float trap was also bypassed as the customer had just opened and cleaned it.

The T1 bearing and thrust bearing feed lines in the front standard were disconnected to flow directly into the standard. The T2 and T3 bearings were rolled to block oil flow into the bearings but allow oil flow beneath the bearings and into the standard. The T4 and T5 bearings were bypassed; oil feed lines were directed straight to drain. The H2 feed lines were directed straight to drain.

The oil flush was started through bearings only – generator H2 seal lines were valved out of service until bearing oil lines were cleaned. Once the H2 seal feed lines were put into service, flow was throttled as required. During the seal oil flush, three to four barrels of oil were drained off the H2 gas side detraining tank and loop seal to clean out the detraining tank. Oil was also drained off the T4/T5 bearing drain enlargement and loop seal to clean up.

The oil flush was started on July 25th, and completed on July 28th due to time constraints.

The system was restored following the flush and all remaining piping to the generator (H2 feed and drain lines) were cleaned out by hand. The T1 Bearing and thrust oil lines were connected, the T2 and T3 bearings were rolled and squared, the T4 and T5 bearing feed lines were connected, and the TE and CE H2 feed and drain lines were installed. New filters were installed in the full flow filter system, Northside. New Cuno filters were installed in the West side filter.

The lube oil tank was drained by the customer following the flush and final cleaned by ALSTOM Power. Once cleaned, the pumps were installed, and the customer refilled the lube oil tank in preparation for return to service.

Recommendations for Future Outages:

1. Replace all steam packing HP/IP/LP.
2. Replace all gland steam packing N1 / N2 / N3 / N4 / N5.
3 Replace impellers on both AC oil pumps.
4. Recommend inspecting Cuno filters and full flow filters per OEM specifications.
5 Replace steam packing springs and retainers.

SHAFT PACKING		
Pkg Box/Casing/Diaph.	Ring Number	
N1	1	658A721P011
N1	2	658A772P011
N1	3	658A772P021
N1	4	658A772P021
N1	5	656A965P025
N1	6	656A965P025
N1	7	656A965P025
HP	8	658A453P019
HP	9	658A452P019
HP	10	658A453P019
HP	11	658A453P019
HP	12	122A6142AE P017
HP	13	122A6142AF P017
HP	14	122A6142AF P017
HP	15	122A6142AG P017
N2	16	122A6142AH P017
N2	17	122A6142AH P018
N2	18	122A6142AH P019
N2	19	122A6142AH P020
N2	20	122A6142AH P021
N2	21	122A6142AH P022
IP	22	122A6142AJ P022
IP	23	122A6142AK P022
IP	24	122A6142AL P022
IP	25	122A6142AK P022
IP	26	658A780P019
IP	27	1141J27P017
IP	28	658A780P019
N3	29	1151J21P017
N3	30	1141J50P017
N3	31	1141J50P017
N3	32	120A806P012

SHAFT PACKING		
Pkg Box/Casing/Diaph.	Ring Number	
N4	33	120A807P015
N4	34	658A786P017
N4	35	658A787P021
N4	36	658A787P021
LP	37	658A642P009
LP	38	658A642P009
LP	39	658A642P009
LP	40	658A642P009
LP	41	658A693P009
LP	42	658A642P009
LP	43	658A642P009
LP	44	658A642P009
LP	45	658A642P009
N5	46	658A787P021
N5	47	658A787P021
N5	48	658A786P017

8.1.2. Disassembly, Inspection and Reassembly of Turbine Valves

Conditions Found

Turbine was at standstill upon arrival. The control valves were intact and the reheat valves cover nuts were loosened. The MSV cover nuts were loosened and the control servo linkage was disconnected. The NRVs were intact. Hydraulic oil was shut down and tagged out.

Work carried out

UPPER AND LOWER CONTROL VALVES

#1

- This valve was disassembled, cleaned and inspected with no issues found.
- The 1# valve was remounted and returned for service.

#2

- This valve was disassembled, cleaned, and inspected.
- Dimensional checks revealed a worn stem and worn bushings.
- A new valve disk, connecting pin, stem, and crosshead bushing were brought from stores and assembled.
- This valve was made ready for service with no other issues to note.

#3

- This valve was disassembled, cleaned, and inspected.
- Dimensional checks proved that the stem to bushing clearance was out of tolerance.
- A new crosshead bushing and stem bushings were installed and made ready for service.

#4

- This valve was disassembled, cleaned, and inspected.
- The crosshead bushing showed excessive clearance.
- A new crosshead bushing was brought from stores and installed.
- The 4# valve was remounted and returned for service.

#5

- This valve was disassembled, cleaned, and inspected.
- Dimensional checks revealed worn stem and bushings.
- A new valve disk, connecting pin, stem, stem bushings, and crosshead bushing were brought from stores and assembled.
- This valve was made ready for service with no other issues to note.

#6

- This valve was disassembled, cleaned, and inspected with no issues found.
- #6 valve was remounted and returned for service.

Control Valve Cam shafts upper and lower

- The cam shafts were found to be in good condition after cleaning.
- Inspections and dimensional checks only revealed one set of DU bearing out of tolerance.
- The DU bearings for one roller were brought from stores and installed.
- All dust cover seals for the camshaft bearing were replaced at this time.
- Rack and pinion gearing was lubricated after assembly.

Springs and Spring Cans

- All six sets of springs were cleaned and MPT inspected for defects.
- Minimal erosion or wear was noted.
- Springs were painted for protection against rust.

BLOWDOWN VALVE

Valve was disassembled, cleaned, inspected, and dimensioned. No issues noted.

The valve head was not disassembled. A water leak check was performed on the bypass valve with good results with no leakage. Dismantling the valve head to examine the bypass valve seat and head could have damaged the valve and the bypass seat and stem head. This component is very difficult to remove and reuse existing parts.

INTERCEPT VALVES

Left Valve

The interior of the body was magnetic particle tested. An indication was noted at the top of the anti-swirl vane. The indication was in the weld metal and was ground out. Another small indication was drilled at the end of the indication forming an arresting hole. The cover bolting was UT tested with no anomalies noted.

Valve was disassembled, cleaned, and inspecte. Dimensioning shows that the clearances between the stem and valve are acceptable. The lever arm bearings are in good shape with no issues.

The intercept control valve seat was in acceptable condition. The intercept stop valve was disassembled and dimensioned. The stem seal was dye pen checked with good results. The stop valve was lapped to the valve body seat for proper seating with the stop valve disk. The intercept control valve was disassembled and dimensioned. The stem and bushing are nearing the upper limit for clearance and should be replaced at the next scheduled outage.

The left valve was completely assembled and made ready for service.

Right Valve

The valve body was magnetic particle tested and visually inspected with no indications noted. The cover bolting was UT tested with no anomalies noted.

During disassembly of stop valve, the anti-rotation pin hole in the stem was damaged in the stop valve. It was not possible to cross drill a new hole for this stem so a new stem was brought from stores and made ready for service.

Dimensioning shows that the clearances between the new stem and valve were acceptable. The lever arm bearings are in good shape with no issues noted.

The intercept control valve was disassembled and inspected. Clearances in the bushing and stem are nearing the maximum tolerance and should be corrected at the next scheduled outage. The intercept control valve seat was in acceptable condition.

The stop valve disk was lapped to the valve body seat for proper mating.

The right side intercept valve was assembled and made ready for service with no issues noted during assembly.

HP MAIN STOP VALVE

Cover Bolting

The cover bolting was UT examined; findings showed no indications. The bolting was made ready for service. During disassembly, three nuts had to be cut off. At assembly, the new nuts would not screw onto the old studs. The bolting has exceeded the predictable lifespan. The treads have deformed and will no longer easily go on for assembly.

Valve Body

The valve body was magnetic particle tested. Indications were noted concerning the anti-swirl vane. Two crack indications were noted on the vane, one on each side of the vane. They were near the top of the vain but not connected to the weld area.

Valve Stem

Dimensioning of the valve stem run-out checks showed the stem was bent on the valve end. Run out was noted to be 0.020”. A new stem was received from stores and put into service with no issues.

Pressure Seal Head

Clearances at the pressure seal head bushing and stem were excessive at 0.025”. A new bushing with oversize material on the OD of the bushing was brought from stores and made ready for service. The stem seal was in good shape and was not renewed. Blue contact check on the steam seal was acceptable.

Valve Disk

The MSV seat was lapped to acceptable contact. The bypass seal and the 3 plugs were lapped to acceptable contact.

NON RETURN VALVES

NRV 101 600psi

This valve was dye pin checked. Checks revealed cracks in the valve body. A new valve body had been ordered for Unit 2 last year. The new valve body was prepped and made ready for service. Studs from the old valve body were removed and used on the new valve body. The old spindle and both packing glands were reused on the new valve body. The disk to seat blue check was satisfactory.

NRV 102 300psi

This valve was disassembled and inspected. New packing and seals were installed. A blue contact checked revealed acceptable results.

NRV 103 150psi

This valve was disassembled and inspected. New packing and seals were installed. A blue contact checked revealed acceptable results

NRV 104A 150psi

This valve was disassembled and inspected. New packing and seals were installed. A blue contact checked revealed acceptable results.

Note: Blue contact was verified by this author, but the confirmation photo was lost.

NRV 104B 150psi

This valve was disassembled and inspected. New packing and seals were installed. A blue contact checked revealed acceptable results.

Note: Blue contact was verified by this author, but the confirmation photo was lost.

NRVs 106 and 109 150psi

These valves were disassembled and inspected. New packing and seals were installed. A blue contact checked revealed acceptable results.

NRV Valve Air Operating Cylinders

All seven air operating cylinders were in poor operating condition. They were all dismantled, cleaned, inspected, and dimensioned. After cleaning and dimensioning, the operating cylinders were tested on the work bench. The 'O' rings and gaskets were replaced with new rings. It was noted that all of the air actuators are heavily rusted and should be replaced. The actuators were assembled and made ready for service.

7. PHOTOGRAPHS

CONTROL VALVES

Blue Chk Seat #1

Blue Chk Seat #2

Blue Chk Seat #3

Blue Chk Seat #4

Blue Chk Seat #5

Blue Chk Seat #6

CV Stem Ends Blue Checks


CV Stem #1


CV Stem #2

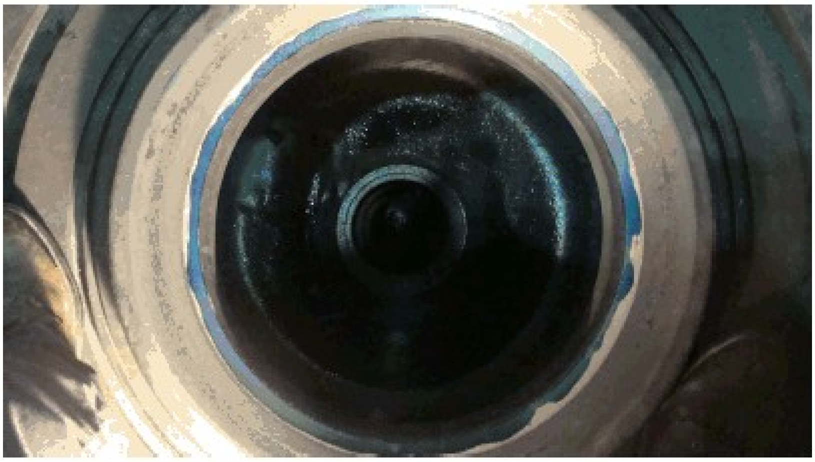

CV Stem #3


CV Stem #4

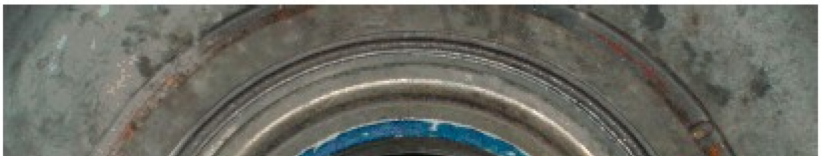

CV Stem #5


CV Stem #6

REHEAT VALVES



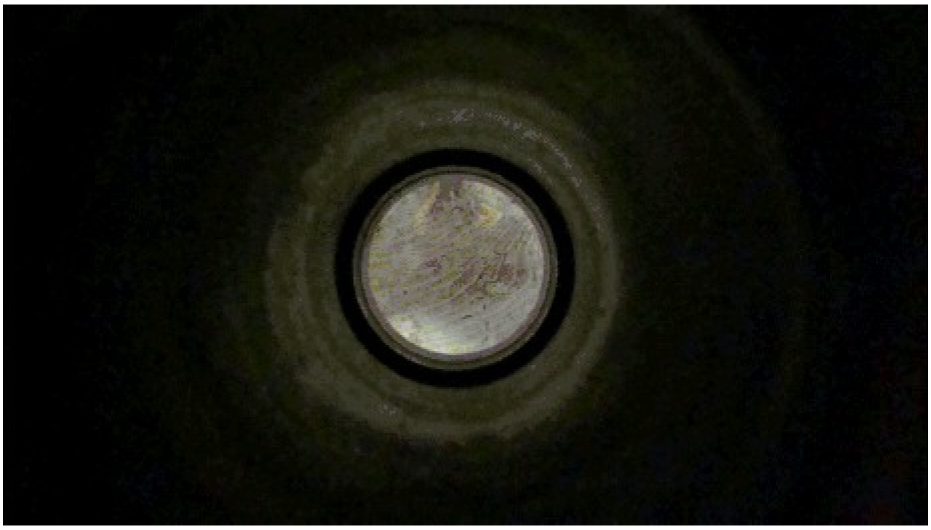
Left Reheat Stop Seat



Left Side Reheat Pilot Seat

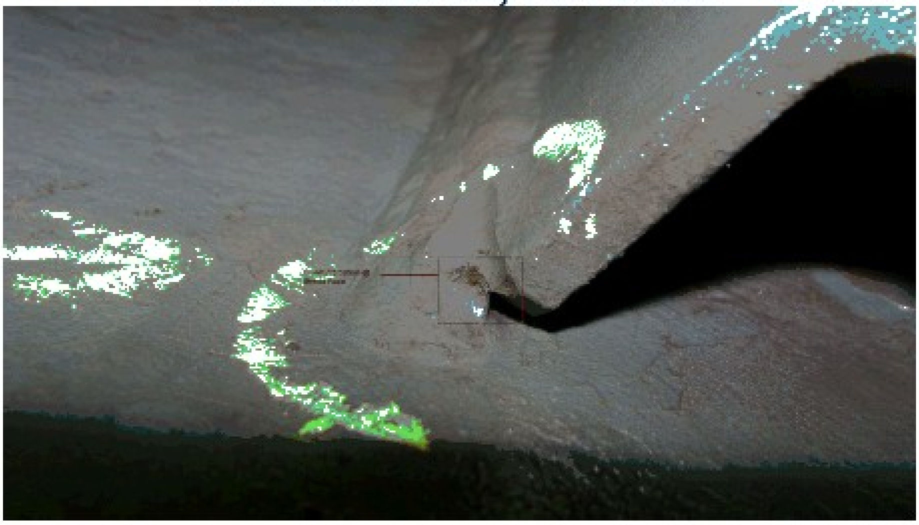
Left Reheat Stem Seal

Right Side Pilot Seat

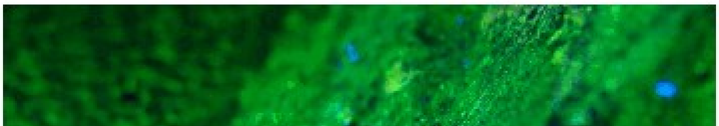


Right Side Stem Seal

Left Side RH Valve Body Anti-Swirl Vane



Anti-Swirl Vane Indication no Black Light



Main Stop Valve

MSV Seat Blue Chk.

Blue Chk. MSV Stem Seal
Visual shows good blue contact

Crack Indications MSV Anti Swirl Vane

Left side at the top of the vane

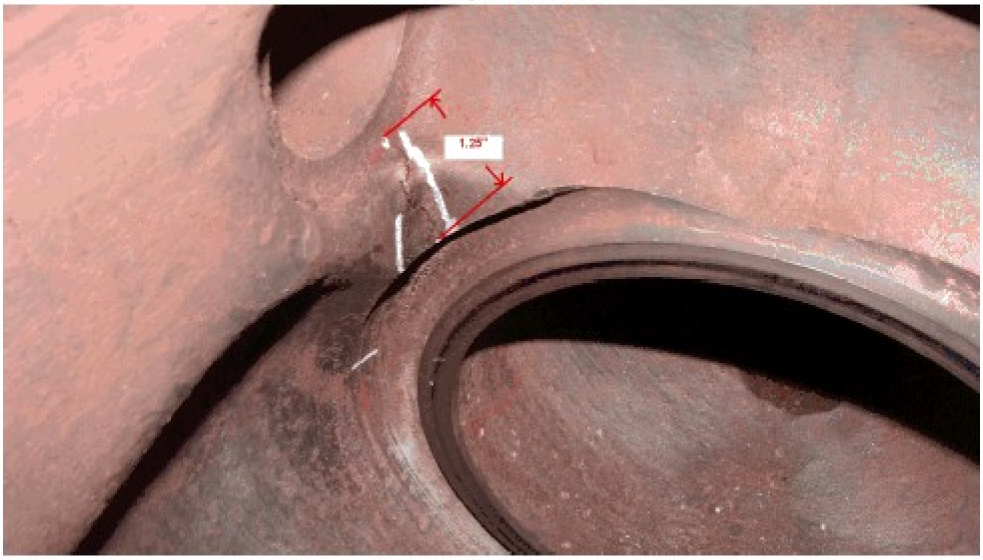
Right side at the top of the vane

Lifting Plug #1 Blue Check

#2

#3

Non Return Valves



Original V101 With Indications

Blue Contact Checks NRV's

NRV Blue Chk # V102

Blue Chk #V106

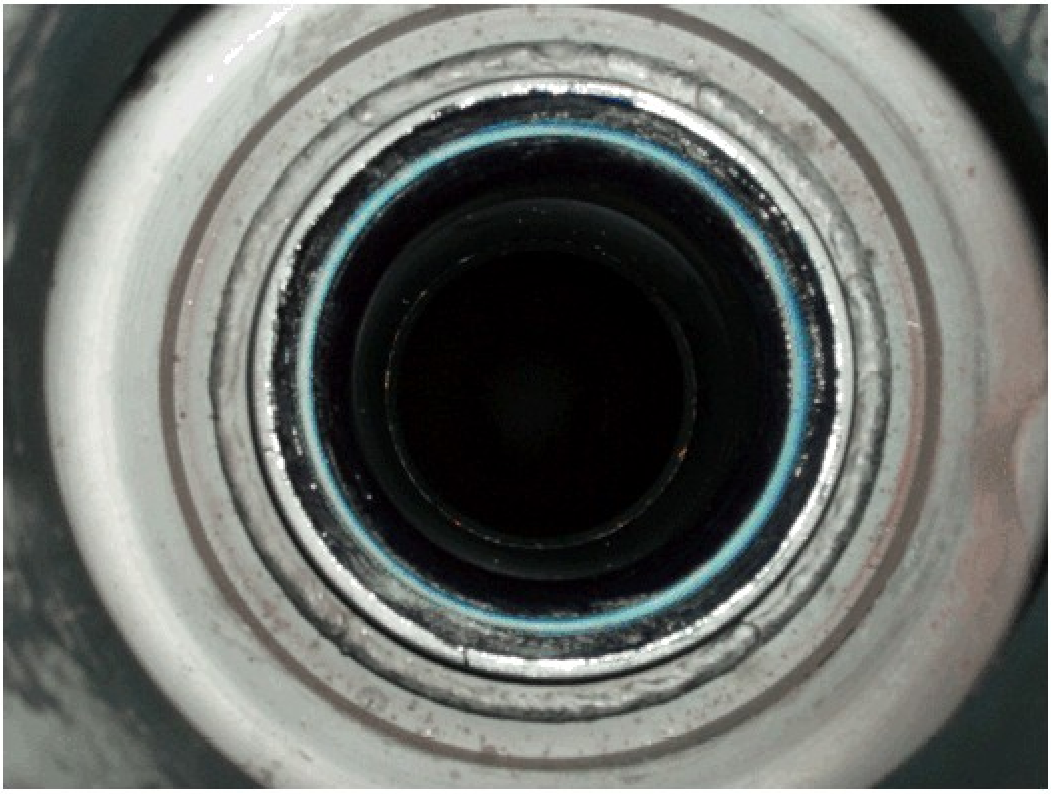
Blue Chk #V109

Typical rust conditions of springs in the NRV air operated actuators

NRV 101 New Valve Body

V101 Blue Chk

Blow Down Valve



Valve Seat Blue Check

RECOMMENDATIONS

- Replace all parts used on this outage. Parts used list is included with report.
- Recommend to acquire services for mobile machining company to drill out the studs on the combined reheat valves and the main stop valve and replace all studs.
- Replace all nuts on the combined reheat valves and main stop valve.
- Replace all of the NRV air operated actuator springs on each NRV. Rust has eroded the springs. The springs no longer have the specified spring rates.
- Monitor the NRVs for proper operation as a preventive maintenance program
- Monitor water content in air supply to NRV actuators as a preventive maintenance program.
- On the main stop valve the as found and as left gap clearance between the valve body and the valve cover is nearing 0.000”. This gap should not be metal to metal tight. Metal to metal tight could mean that the spiral wound gasket is not correctly crushed. Before the next outage it is recommended to contact ALSTOM Engineering for the correct gap between the cover and the valve body.
- This would be a good opportunity to replace all of the studs on the main stop valve and machining the valve body to allow for proper cover to valve body gap.

ENCLOSURES

Parts used Unit 1 Valve Outage 06-12

Stock #	Description	Quanity
	INTERCEPT VALVES	
56200057	Reheat Gasket Pressure Seal Head	3
56200063	Reheat Gasket Cover	2
54900013	Nut Reheat Cover	4
58601520	Stem Reheat Stop Valve	1
58601536	Stop RH Antirotation Pin	1
58500105	Stud Reheat Valve Cover	1
	BLOW DOWN VALVE	
58600462	Nut Cover	3
56200061	Cover Gasket spiral wound	1
	MAIN STOP VALVE	
58601606	Nut Cover	3
56200059	MSV Cover Gasket	1
56200058	MSV Pressure Seal Head Gasket	1
	Valve Stem	1
58603037	MSV Stem Bushing Over size Material OD	1
	NRV VALVES	
58601479	Link Tail V101	1
58800389	NRV 106,109 Spiral Wound Gasket pos 22	4
58800394	NRV 101 Spiral Gasket pos 22	2
58800391	NRV 102, 104A,B 103 Spiral Gasket pos 22	8
58800383	NRV 109 Spiral Gasket pos23	1
58800388	NRV 101 Spiral Gasket pos 23	2
58800385	NRV 104A, 104B Spiral Gasket pos 23	2
58800387	NRV 102,103 Spiral Gasket pos 23	2
58800384	NRV 106 Spiral Gasket pos 23	1
58800399	NRV 101, 102 Packing Set	1
58800398	NRV 103 Packing Set	1
58800397	NRV 104A, 104B Packing Set	2
58800396	NRV 106 Packing Set	1
58800395	NRV 109 Packing Set	1

58800361	O' Ring 104A, 104B	2
58800367	O' Ring 104A, 104B, 101,102,103	5
???	1/64" Garlock Gasket 2'x2'	1
58800365	O' Ring NRV 106,109	2
58800359	O' Ring NRV 106,109	2
43000008	Bearing Assembly V101	1
	Flaper Valve Disk V101	
58601465	**HP CONTROL VALVES**	1
58601530	Pin Stem to Valve	2
43000004	DU Bearing Lever Arm	6
58603036	Cup Seat, Valve Stem Length Adjust	1
58601474	Pin Stem to Crosshead	6
58606319	CV Stem	2
58601598	CV Upper Crosshead Bush	2
58603025	Gasket Valve Stand to Casing	6
56500025	Dust Klozure Garlock	16
58602993	Control Valve Disk (Lower)	1
58601529	Control Valve Disk (Upper)	1
58603075	Cross head Bushing Lower	1
58600462	Nut CV Stands	6
56200162	Leak Off Gasket	1
56200180	Leak Off Gasket	2
56200133	Leak Off Gasket	6
56200020	Leak Off Gasket	1
56200146	Leak Off Gasket	8
56200178	Leak Off Gasket	1

8.1.3. Disassembly, Inspection and Reassembly of Generator

Disassembly

During disassembly as found readings were taken on the fan tip clearances and radial rotor positions. An "as found" coupling alignment was recorded and found to be acceptable.

One of the fiber winding cover support studs was damaged during disassembly. New studs were ordered and installed.

The collector end end shield horizontal joint dowels were found to be bent when they were removed. The tops of the dowels were mushroomed from being driven in. New dowels were ordered and installed during reassembly.

Please refer to the generator specialist report for results of the inspection and testing of the generator stator and generator field.

Inspection

Electrolysis was found on the #4 journal. The journal was found with oxidation where the grounding brushes make contact. One of the brushes was found with a loose spring. The grounding brush rigging was replaced with new. The journal area was cleaned to allow good contact at the grounding brushes. See IIR Gen001 in the enclosures that addresses this finding.

The seal oil system was found to be very dirty. Sludge was found in the hydrogen seal casings, grooves, and return lines. The system was found to be very dirty. IIR Gen002 addresses the seal oil system condition.

The hydrogen seals were found with light scoring. The diametrical measurements taken indicate that the seals were out of tolerance and should be ordered for the next major outage. It is recommended to send the hydrogen seal casings and rings to a vendor such as RPM to be refurbished during the next major outage. The seals were blue contact checked to the hydrogen seal casings and lapped to achieve 100% contact.

The inner oil deflector at #4 and #5 bearings were found to be out of tolerance. Oil seals were not available on site for replacement. Seals should be ordered and sent to site. The seals should be installed and machined to size during the next major outage.

The hydrogen seal casing oil deflectors were found to be worn and out of tolerance. IIR Gen005 in the enclosures addresses the worn seals.

A back of core and bellyband inspection was performed. The front bellyband was found with greasing. No clearance was found between the bellyband and the key bars. The bolts were re-torqued to specification. The nuts turned approximately ¼ of a turn during tightening. The bellyband should be monitored during future inspections and tightened if the condition worsens. Refer to IIR Gen004 in the enclosures.

The collector rings were found to be 0.006” and 0.007” out of round. The groove depth was found acceptable. IIR Gen003 in the enclosures section was submitted, and it was recommended to machine the collector rings on turning gear and polished at full speed.

The bushing box was opened and cleaned. Viscasil was added to the bushings by the plant electricians.

The generator bearings showed signs that indicated a lot of time on turning gear with dirty lube oil. The dimensional measurements were within acceptable limits. See bearing clearance data sheet in the turbine report.

The generator grounding straps were inspected at the 4 point on the generator stator. The straps were found in good condition and the connections were found tight.

Reassembly

During reassembly, the step of the vertical joint of the hydrogen seal casing was adjusted to be within 0.0015”. The weight of the rotor was taken off from the bottom end shield while the upper and lower end shields were bolted together. The weight of the rotor remained off from the bottom end shield while the upper and lower end shields were bolted together. Once the vertical step joint was adjusted, the horizontal and vertical joints of the end shields were bolted final and the generator rotor was set into the bearings.

The inner oil deflectors were installed and set per procedure. Clearances on the bottoms were set at 0.005”/0.006” and even side to side.

The H2 seal casings were installed and bolted. During the assembly of the CE H2 seal casing, the seal casing was found to be grounded. Seal casing was removed, cleaned, and reassembled. The final megger was good. Once the casing was lock-wired final, a final megger was completed and found the seal casing was good.

At final installation of the T4 and T5 bearings, bearing twist and tilt checks were performed and corrected as required. Plant I&C connected all instrumentation.

The T4 and T5 outer oil deflectors were set at 0.005”/0.006” on the bottom and even side to side.

The T4 and T5 bearing rings and covers were installed after the start of the air test so that a visual inspection could be done on the H2 seal casings once the air test had started.

Following reassembly of the generator and unit on turning gear, the collector rings were ground by Ontech Machining to “re-round” the collector rings and remove the 0.007” out of round. The shaft grounding brush area could not be machined at this time as the compound was too large to fit into the space. This area was strap lapped while on turning gear to improve the contact area. The following are the as measured ring sizes, as recorded by OnTech, and the as finished sizes of the inboard and outboard rings.

Inboard Ring

As Found: 13.310" / 13.316"

As Finished: 13.279" / 13.279"

Outboard Ring

As Found: 13.275" / 13.263"

As Finished: 13.238" / 13.2385"

Centerline Key clearances at reassembly:

TE L/S = 0.005"

TE R/S = 0.006"

CE L/S = 0.002"

CE R/S = 0.002"

9. Work carried out internal

Nothing to report

10. Open Items

Nothing to report

11. Open Items internal

Nothing to report

12. Instruments and tools internal

Nothing to report

13. Spare parts

Unit / Component		HOLYROOD 1 / Steam Turbine			
Type of spare part		Used spare parts / material			
No.	Description	Part Number	Total	Replaced	Remarks
1	Packing springs		3	3	packing springs rows 31 and 32
2	Horizontal Joint Stud		1	1	Horizontal Joint stud number 40
3	Nut		1	1	Nut for Horizontal Joint stud number 40
4	Cross Over Gaskets LP side		4	4	LP Hood cross over gaskets
5	Cross Over Gaskets IP Side		2	2	IP Flange Cross Over Gasket
6	AC Lube Oil Pump shaft		1	1	
7	Impeller nut		1	1	AC Lube Oil Pump
8	Main Steam Inlet Gasket		1	1	

14. Software backup and data

Nothing to report.

15. Feedback and experiences internal

Nothing to report

16. Sales opportunities internal

Nothing to report

17. EHS Internal

Event Reporting

Explication: This section is used to identify and track EHS events during fieldservice activities. Please identify every event which you have reported during your mission. It is your duty to report every EHS relevant observations directly to the local responsible person (site management; EHS manager; ...). The event report itself is not transmitted via eFSR due to legal and privacy aspects.

No.	Date	Type of Event	Short Description	Event reported to
1				

Preventive Actions

Explication: This section is used to identify and track EHS preventive actions. Please identify the main actions you have taken to prevent accidents and incidents during your mission.

No.	Date	Type of Action	Short Description	Preventive Actions reported to
1				

18. Competitor activities internal

Nothing to report

19. FSI internal

Nothing to report

20. NCR internal

Nothing to report

21. Appendix

Unit / Component	HOLYROOD 1 / HP Outer Shell
Appendix No.	1
Description	Outer shell removal

Unit / Component	HOLYROOD 1 / LP Hood
Appendix No.	2
Description	LP Hood removal

Unit / Component	HOLYROOD 1 / HP.IP Inner cylinder
Appendix No.	3
Description	HP/IP Inner cylinders prior to removal

Unit / Component	HOLYROOD 1 / LP
Appendix No.	4
Description	LP Inner cylinder prior to removal

Unit / Component	HOLYROOD 1 / HP Lower Nozzle
Appendix No.	5
Description	Lower Nozzle

Unit / Component	HOLYROOD 1 / HP Lower Nozzle
Appendix No.	6
Description	Lower Nozzle Plate

Unit / Component	HOLYROOD 1 / HP Upper Nozzle Plate
Appendix No.	7
Description	Upper Nozzle Plate

Unit / Component	HOLYROOD 1 / Upper Nozzle Plate
Appendix No.	8
Description	Upper Nozzle Plate

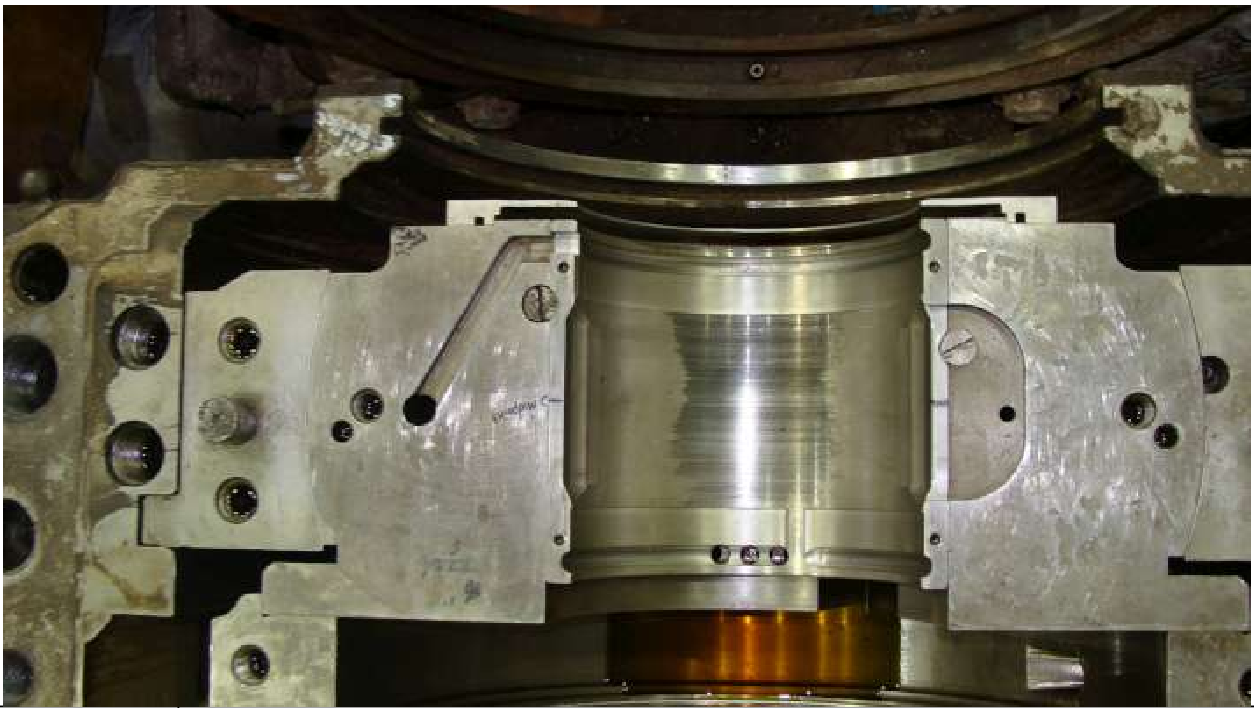
Unit / Component	HOLYROOD 2 / HP/IP/LP rotor
Appendix No.	9
Description	Rotor removal

Unit / Component	HOLYROOD 1 / H2 Detraining Tank
Appendix No.	10
Description	Debris from H2 detraining tank during oil flush

Unit / Component	HOLYROOD 1 / T4/T5 Bearing Drain enlargement
Appendix No.	11
Description	Debris from Bearing Drain enlargement during oil flush

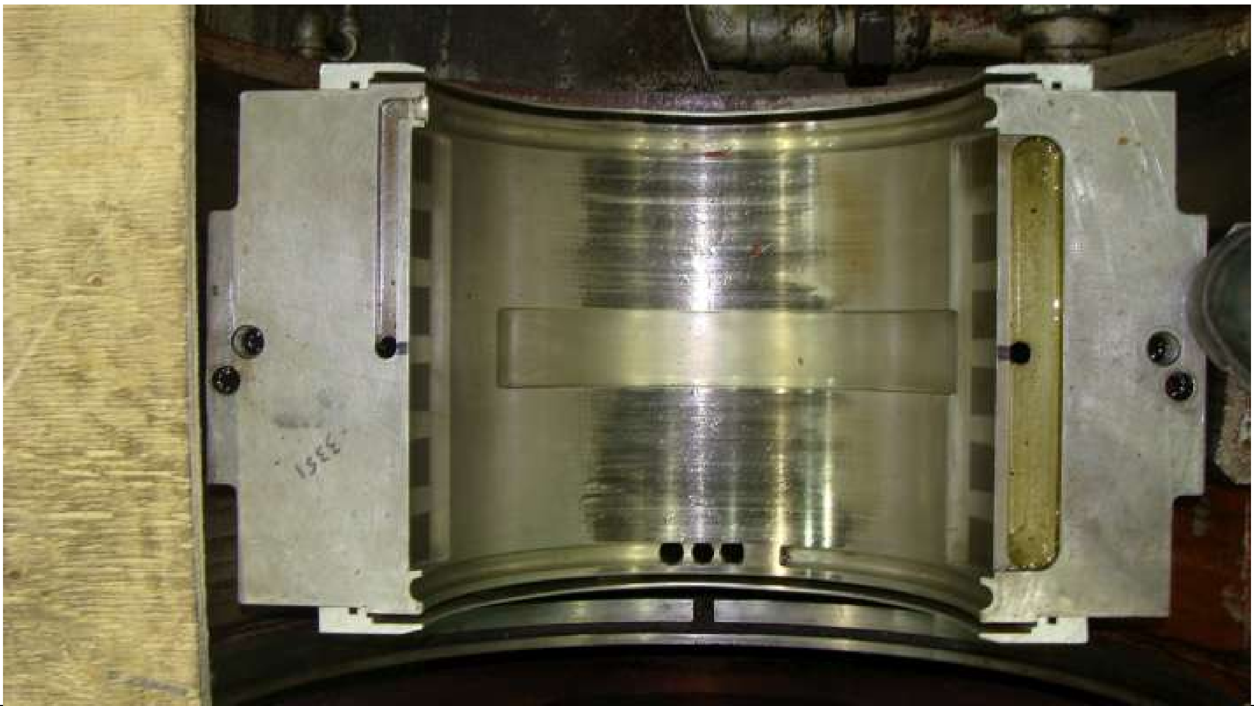
Unit / Component	HOLYROOD 1 / Cuno filters
Appendix No.	12
Description	Cuno filter that was in service

Unit / Component	HOLYROOD 1 / Cuno Filters
Appendix No.	13
Description	Cuno Filters that were in service



Unit / Component	HOLYROOD 1 / T1 Bearing Lower Half
Appendix No.	14
Description	Lower Half T1 Bearing

Unit / Component	HOLYROOD 1 / T2 Lower Half Bearing
Appendix No.	15
Description	Lower Half Bearing



Unit / Component	HOLYROOD 1 / T3 Lower Half Bearing
Appendix No.	16
Description	Lower half bearing

22. Appendix internal

No item included

23. Enclosure

No.	1
Description	Turbine Test Certs
Reference Number	
Pages	44

No.	2
Description	Steam Turbine IIR
Reference Number	
Pages	7

No.	3
Description	Valve Certs
Reference Number	
Pages	22

No.	4
Description	Generator Test Certs
Reference Number	
Pages	7

No.	5
Description	Generator Interim Inspection Reports
Reference Number	
Pages	13

No.	6
Description	TEAM NDE Inspection Report
Reference Number	
Pages	16

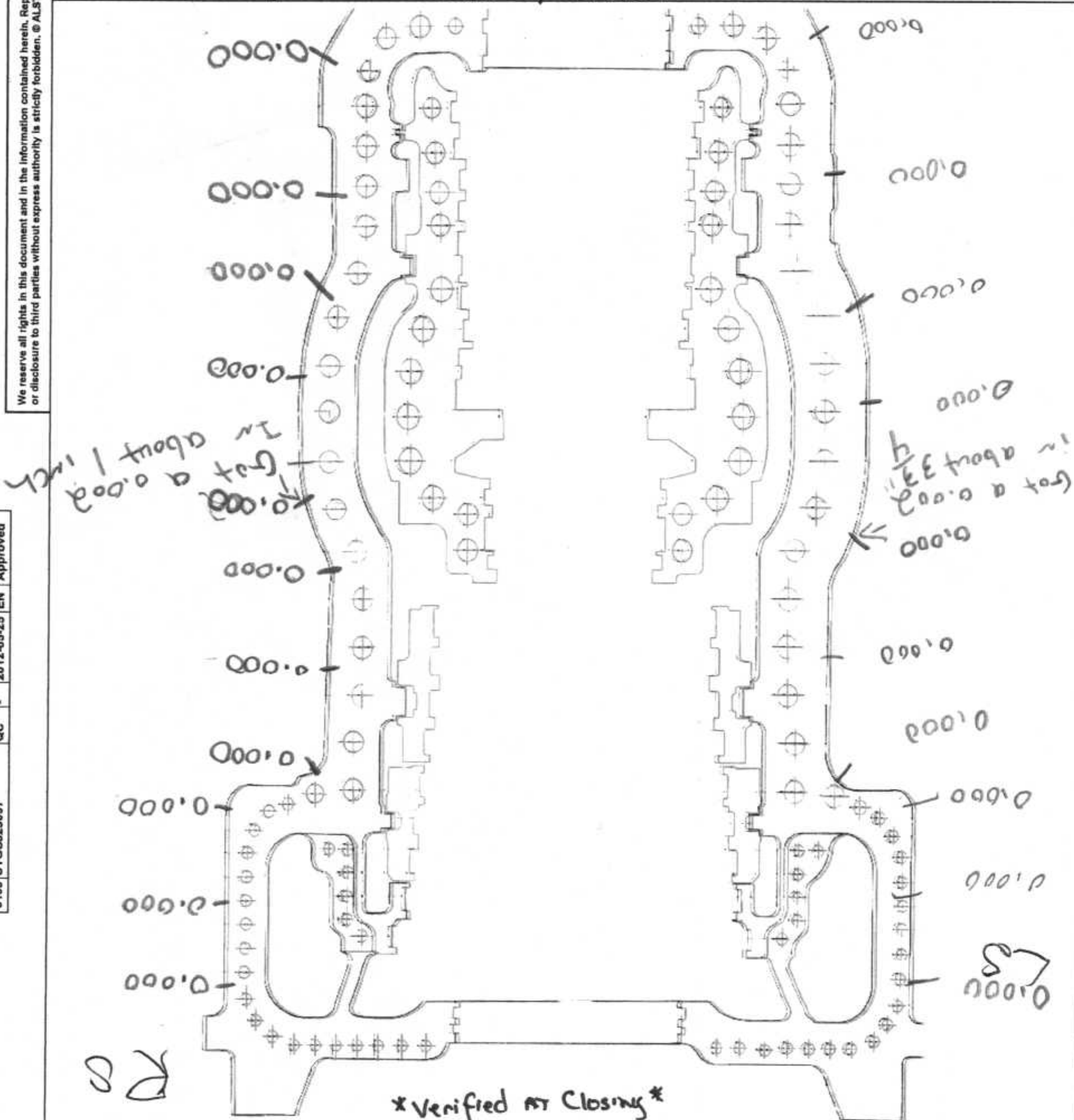
24. Enclosure internal

No.	1
Description	Steam Turbine and Valves I&T Plan
Reference Number	
Pages	31

No.	2
Description	Generator I&T Plan
Reference Number	
Pages	8

Dept.	Document No.	Type	Rev	Released	Lng.	Status
6105	UTGS623097	QC	-	2012-05-25	EN	Approved

Test Certificate	Title: **HP/IP Horizontal Joint Gap Measurements** "OPEN & CLOSE"



Verified AT Closing

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: Holyrood Unit 1		
	NC-Report*		Rework*				
NCR No.*					Part Text: Joint Gaps Open & Close		Quantity
Checked by**: G. Lallon					Part Idnr	Rev.	Power Station Designation
Approved by**: RM Scott					I & T Plan ID	Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.		Factory Order
ALSTOM					Sheet No.: 1	No. of Sh.: 1	Document No.: UTGS 623097 / Rev.: -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623112	QC	-	2012-05-25	EN	Approved

Test Certificate

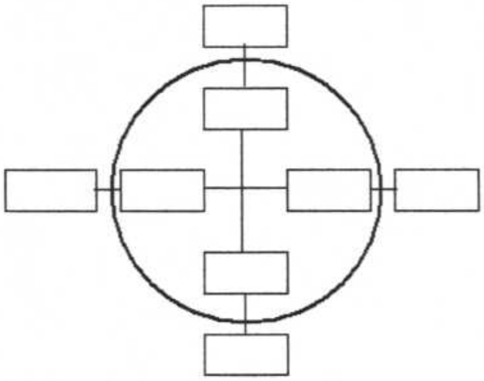
Title: **Coupling Alignment**

Coupling: LP/Gen

Sweep Diameter:

Indicator Mounted on: Gen

Reading: LP



Alignment Readings

Position	Top	Right	Bottom	Left
Rim (Mils)	0	-.008	-.010	-.0015
Face 0°				
Face 90°				
Face 180°				
Face 270°				
Average	995.1	995.5	994.2	994.6
Relative				

Check	Face	Rim
Top + Bottom =		
Right + Left =		
Difference =		

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: Holyrood Generating Station Unit 1	
	NC-Report*		Rework*			
NCR No.*					Part Text: LP/Gen Alignment "As found"	Quantity
Checked by**: G. Lallon					Part Idnr*	Rev. / Power Station Designation
Approved by**: R M Scott					I & T Plan ID	Rev. / Test Step / Material Test No.
Authority / Customer**					Order No.	Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 4	Document No. UTGS 623112 / Rev. -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623112	QC	-	2012-05-25	EN	Approved

Test Certificate

Title

Coupling Alignment

Coupling: LP/Gen

Data: As Found
(As found/Final)

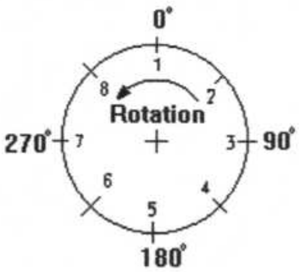


Fig. 1.

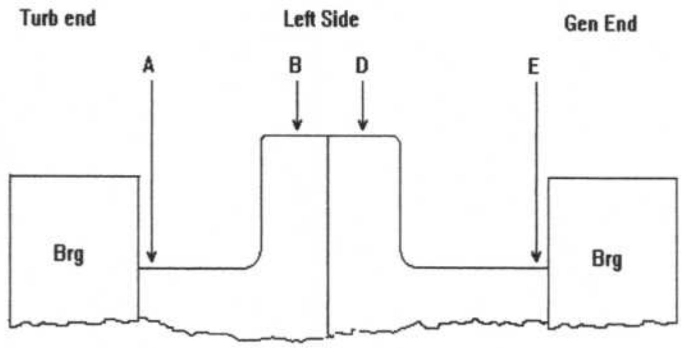


Fig. 2

NOTES:
(1) For radial runout set indicator to read "0" ar the number 1 position.
(2) Mark positions 1-8 to agree with factory stamped degree marks on rotor as shown on Fig. 1.

Coupling Runouts

Area Indicated		Position Number 1 0°	2 45°	3 90°	4 135°	5 180°	6 225°	7 270°	8 315°	1 0°
TE Journal	A	.000		.001		.001		.600		.006
TE Cplg. Periphery	B	.000		-.001		.002		.0015		.006
GE Cplg. Periphery	D	.000		-.0005		-.001		-.0015		.000
GE Journal	E	.000		.000		-.0015		-.001		.000

Differential Runouts

Journals	A - E									
Cplg. Periphery	B - D									

Maximum Runouts

Area Indicated		Data Check	TIR Runout	TIR Check
TE Journal	A			
TE Cplg. Periphery	B			
GE Cplg. Periphery	D			
GE Journal	E			

Maximum Differential Runouts

		Max. Diff.	Diff. Check
Journals	A - E		
Cplg. Periphery	B - D		

Unit / System Name	Order No.			Factory Order	
ALSTOM	Sheet No. 2	No. of Sh. 4	Document No.	UTGS 623112	Rev. -

Test Certificate

Title: **Coupling Alignment**

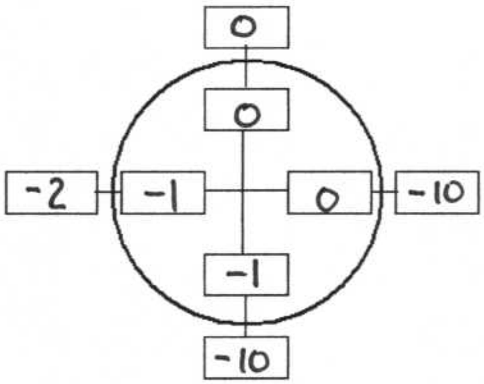
Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623112	QC	-	2012-05-25	EN	Approved

Coupling: LP/GEN

Sweep Diameter:

Indicator Mounted on: GEN

Reading: LP



Alignment Readings

Position	Top	Right	Bottom	Left
Rim (Mils)	0	-.010	-.010	-.002
Face 0°	700	699	699	699
Face 90°	699	698	698	698
Face 180°	700	700	699	699
Face 270°	700	699	700	699
Average	699.75	699	699	698.75
Relative				

Check	Face	Rim
Top + Bottom =		
Right + Left =		
Difference =		

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: Holyrood Generating Station Unit 1
	NC-Report*		Rework*		
NCR No.*					Part Text: LP/GEN Coupling "Assemble" — Quantity:
Checked by**: B. Corcoran					Part Idnr — Rev. — Power Station Designation
Approved by**: R. Scott					I & T Plan ID — Rev. — Test Step — Material Test No.
Authority / Customer**					Order No. — Factory Order
ALSTOM					Sheet No.: 1 — No. of Sh.: 4 — Document No.: UTGS 623112 — Rev.: -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623112	QC	-	2012-05-25	EN	Approved

Test Certificate

Title

Coupling Alignment

Coupling: LP/GEN

Data: 8/4/12
(As found/Final)

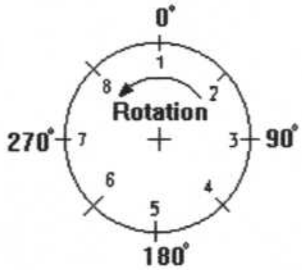


Fig. 1.

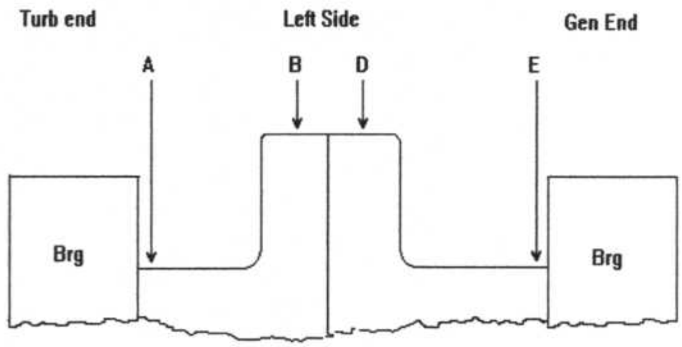


Fig. 2

NOTES:
(1) For radial runout set indicator to read "0" ar the number 1 position.
(2) Mark positions 1-8 to agree with factory stamped degree marks on rotor as shown on Fig. 1.

Coupling Runouts

Area Indicated		Position Number 1 0°	2 45°	3 90°	4 135°	5 180°	6 225°	7 270°	8 315°	1 0°
TE Journal	A	0		0		0		0		0
TE Cplg. Periphery	B	0		0		+1		+1		0
GE Cplg. Periphery	D	0		0		+½		+¾		0
GE Journal	E	0		+½		0		0		0

Differential Runouts

Journals	A - E	0		+¼		0		0		0
Cplg. Periphery	B - D	0		0		+¼		+¼		0

Maximum Runouts

Area Indicated		Data Check	TIR Runout	TIR Check
TE Journal	A			
TE Cplg. Periphery	B			
GE Cplg. Periphery	D			
GE Journal	E			

Maximum Differential Runouts

		Max. Diff.	Diff. Check
Journals	A - E		
Cplg. Periphery	B - D		

Unit / System Name	Order No.	Factory Order

ALSTOM	Sheet No.	No. of Sh.	Document No.	Rev.
	2	4	UTGS 623112	-

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623111	QC	-	2012-05-25	EN	Approved

Test Certificate

Title

Coupling Bolt Assembly

"ASSEMBLY"

Coupling LP/GEN

Bolt Effective Length ______

Required Stretch .020 = 1.5 x Effective length

BOLT NUMBER	RELAXED LENGTH	FINAL LENGTH	TOTAL STRETCH
1	19.509	19.528	.019
2	19.445	19.464	.019
3	19.535	19.555	.020
4	19.406	19.425	.019
5	19.517	19.537	.020
6	19.520	19.539	.019
7	19.516	19.535	.019
8	19.510	19.531	.021
9	19.487	19.509	.022
10	19.522	19.542	.020
11	19.520	19.540	.020
12	19.503	19.523	.020
13			
14			

* Readings taken with micrometer And Temp Bolts on each end of coupling bolts for good measuring surface.

Unit / System Name	Order No.	Factory Order	
LP/GEN Coupling			

ALSTOM	Sheet No.	No. of Sh.	Document No.	Rev.
	2	2	UTGS 623111	-

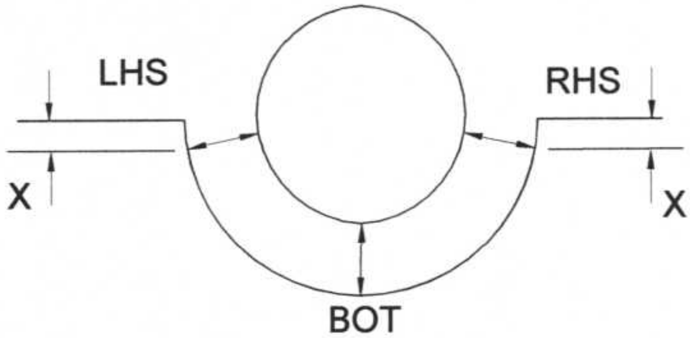
Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623110	QC	-	2012-05-25	EN	Approved

Test Certificate

Title

Rotor Positions and Bridge Gauge Reading

"AS FOUND"



DATE	BEARING #	LHS	BOT	RHS	BRIDGE GAUGE
	1	2.295	2.251	2.327	
	2	5.372	5.359	5.371	
	3	5.870	5.858	5.882	
	4				
	5				
	6				

Unit / System Name	Order No.	Factory Order

ALSTOM		Sheet No.	No. of Sh.	Document No.	Rev.
		2	2	UTGS 623110	-

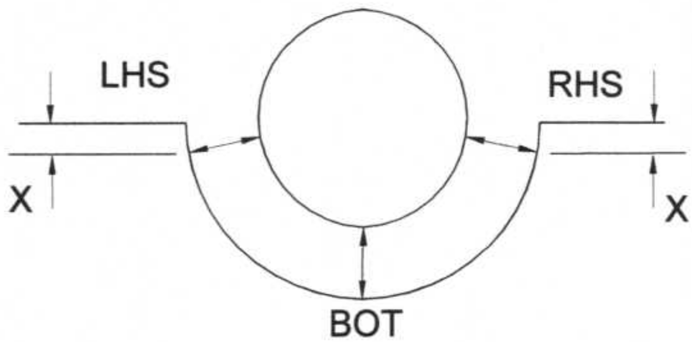
Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623110	QC	-	2012-05-25	EN	Approved

Test Certificate

Title

Rotor Positions and Bridge Gauge Reading

"FINAL"



DATE	BEARING #	LHS	BOT	RHS	BRIDGE GAUGE
	1	2.295	2.250	2.328	
	2	5.372	5.359	5.372	
	3	5.871	5.858	5.883	
	4				
	5				
	6				

Unit / System Name	Order No.			Factory Order	
ALSTOM		Sheet No. 2	No. of Sh. 2	Document No. UTGS 623110	Rev. -

Test Certificate	Title: Diaphragm Clearance Instructions " AS FOUND"

ROTOR ROTATIONAL POSITION DURING CLEARANCE CHECKS

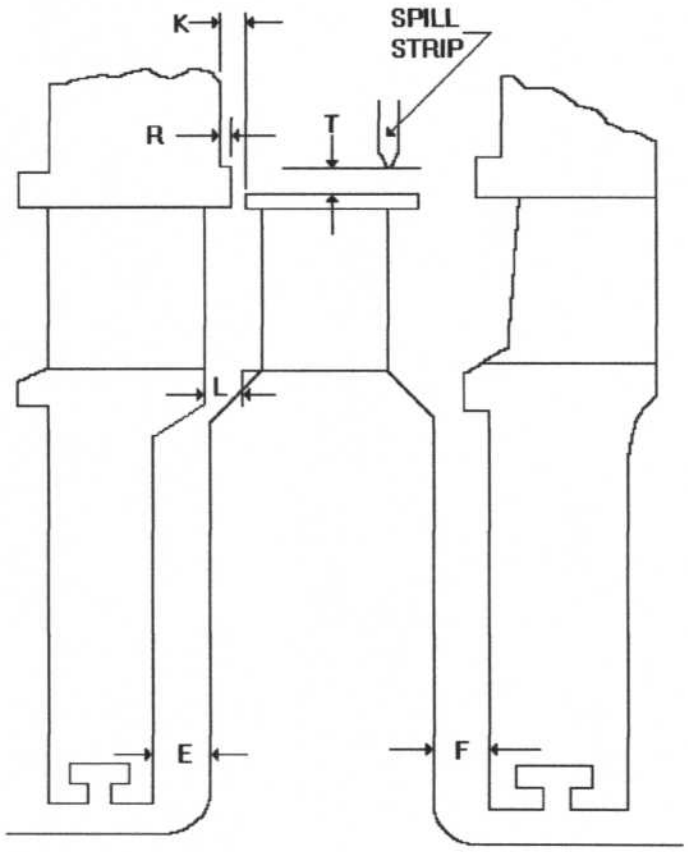
NUMBER_____ ON COUPLING RIM AT 12 O'CLOCK

Note 1: Left & right is as viewed from front of turbine looking toward the generator.

Note 2: Clearances are to be recorded with rotor pushed toward thrust bearing.

Note 3: Dimension stamped on bearing bracket is the average distance from HP Head vertical face to the nearst thrust collar face.

Note 4: Columns without titles are for field computations.



Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: Holyrood Generating Station Unit 1	
	NC-Report*		Rework*			
NCR No.*					Part Text: HP/IP & LP Turbine Clearances - Disassembly	Quantity
Checked by**: G. Lallon					Part Idnr / Rev.	Power Station Designation
Approved by**: R M Scott					I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.	Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 3	Document No. UTGS 623116 / Rev. -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title

Diaphragm Clearance Measurements

"AS FOUND"

LEFT SIDE

Stage Number	T	K	L		E		F
1		.152					
2		.124	.115				
3		.098	.080		.680		.488
4		.090	.090		.680		.493
5		.092	.098		.645		.505
6		.102	.089		.523		.550
7		.090	.097		.555		.555
8		.080	.093		.568		.525
9		.088	.106		.237		.537
10	-	-	-		-		-
11		.180			.490		.580
12		.176	.175		.505		.565
13		.205	.210		.487		.635
14		.210	.208		.555		.490
15		.227	.214				.557
16	-	-	-		-		-
17		.220	.225		.488		.568
18		.280	.331		.693		
5T		.512					
4T		.348					
3T		.392					
2T		.458					
1T		.371					
1G		.355					
2G		.410					
3G		.457					
4G		.412					
5G							

Unit / System Name	Order No.			Factory Order	
Holyrood Generating Station - Unit 1					
ALSTOM	Sheet No. 2	No. of Sh. 3	Document No. UTGS 623116		Rev. -

Test Certificate

Title

Diaphragm Clearance Measurements

"AS FOUND"

RIGHT SIDE

Stage Number	T	K	L		E		F
1		.170					
2		.144	.115				
3		.110	.115		.681		.494
4		.095	.095		.625		.498
5		.105	.100		.652		.511
6		.095	.102		.525		.553
7		.093	.090		.560		.554
8		.078	.101		.570		.530
9		.087	.104		.238		.540
10	-	-	-		-		-
11		.175			.475		
12		.187	.174		.490		.577
13		.190	.203		.510		.568
14		.165	.305		.485		.635
15		.224	.212		.555		.490
16	-	-	-		-		-
17		.213	.232		.464		
18		.262	.305		.693		.496
5T		.498					
4T		.400					
3T		.374					
2T		.433					
1T		.378					
1G		.375					
2G		.403					
3G		.467					
4G		.418					
5G							

Unit / System Name		Order No.			Factory Order	
Holyrood Generating Station - Unit 1						
ALSTOM		Sheet No. 3	No. of Sh. 3	Document No.	UTGS 623116	Rev. -

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623116	QC	-	2012-05-25	EN	Approved

Test Certificate | Title: **Diaphragm Clearance Instructions**

ROTOR ROTATIONAL POSITION DURING CLEARANCE CHECKS

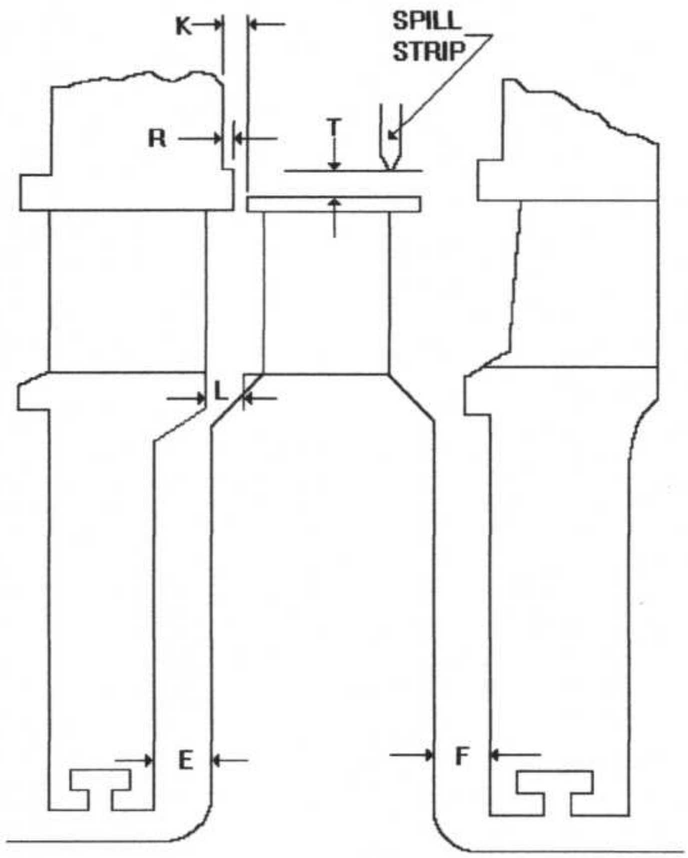
NUMBER_____ ON COUPLING RIM AT 12 O'CLOCK

Note 1: Left & right is as viewed from front of turbine looking toward the generator.

Note 2: Clearances are to be recorded with rotor pushed toward thrust bearing.

Note 3: Dimension stamped on bearing bracket is the average distance from HP Head vertical face to the nearst thrust collar face.

Note 4: Columns without titles are for field computations.



Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: Holyrood Generating Station Unit 1	
	NC-Report*		Rework*			
NCR No.*					Part Text: HP/IP & LP Clearances – Assembly	Quantity
Checked by**: G. Lallon					Part nr / Rev.	Power Station Designation
Approved by**: RM Scott					I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.	Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 3	Document No. UTGS 623116 / Rev. -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623116	QC	-	2012-05-25	EN	Approved

Test Certificate

Title: Diaphragm Clearance Measurements
'Final'

LEFT SIDE

Stage Number	T	K	L		E		F
1		152					
2		124					
3		107	097				
4		104	109				
5		107	109				
6		109	104				
7		099	104				
8		095	99				
9		098	119				
11		191	190				
12		195	173				
13		203	208				
14		219	213				
15		223	211				
17		221	221				
18		276	328				

Unit / System Name	Order No.			Factory Order	
ALSTOM	Sheet No. 2	No. of Sh. 3	Document No.	UTGS 623116	Rev. -

Test Certificate	Title: Diaphragm Clearance Measurements 'FINAL'

RIGHT SIDE

Stage Number	T	K	~~R~~ L		E		F
1		159					
2		147					
3		109					
4		108	109				
5		111	114				
6		107	114				
7		104	105				
8		097	116				
9		094	114				
11		194	193				
12		194	166				
13		206	211				
14		211	206				
15		231	211				
17		234	216				
18		265	324				

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623116	QC	-	2012-05-25	EN	Approved

Unit / System Name	Order No.			Factory Order	
ALSTOM	Sheet No. 3	No. of Sh. 3	Document No.	UTGS 623116	Rev. -

Test Certificate

Title

Diaphragm Clearance Measurements

LEFT SIDE
'FINAL'

Stage Number	T	K	L		E		F
5T		518					
4T		438					
3T		414					
2T		469					
1T		384					
1G		369					
2G		406					
3G		456					
4G		411					
5G							

Unit / System Name	Order No.			Factory Order	
ALSTOM	Sheet No.	No. of Sh.	Document No.	UTGS 623116	Rev. -

Test Certificate	Title Diaphragm Clearance Measurements

RIGHT SIDE
'Final'

Stage Number	T	K	R		E		F
5T		509					
4T		416					
3T		387					
2T		459					
1T		394					
1G		371					
2G		403					
3G		463					
4G		419					
5G							

Unit / System Name	Order No.			Factory Order	
ALSTOM	Sheet No.	No. of Sh.	Document No. UTGS 623116		Rev. -

Test Certificate	Title: Seal Segment Clearance Measurement Instructions

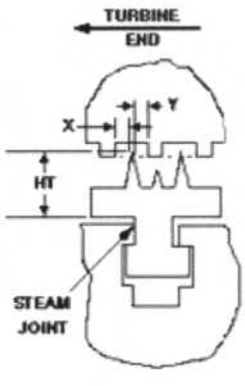


FIG 1.

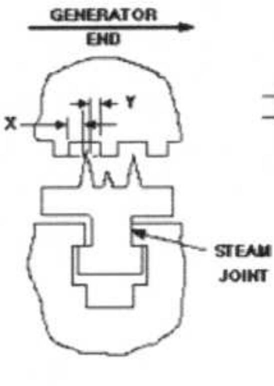


FIG. 2

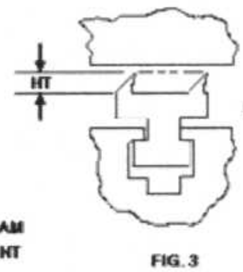


FIG. 3

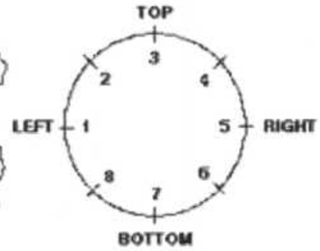


FIG. 4

Notes For Checking Packing Clearances

1. Each ring must always be held against the steam seal side of the neck of the packing ring when checking clearances. The packing assembly drawings should be checked to be certain which side of the packing is the steam seal side.

2. The rotor must be blocked away from the generator as far as thrust allows when checking clearances.

3. The "X" clearance is always on the side of the packing long tooth toward the turbine end of the turbine and "Y" is the clearance on the side of the packing long tooth toward the generator. The clearance is the minumum distance at the point measured.

4. The packing assemblies are numbered starting from the turbine end of the machine and working toward the generator. The packing rings in one assembly are also numbered from the turbine end of the assembly working toward the generator. When recording measurements for steam packing, fill in packing and ring column with packing assembly number first, followed by a dash, then the ring number. In this instance the diaphragm stage columns will be left blank. When recording measurements for diaphragm packing, the packing and ring number column will be left blank.

5. Prior to packing segment removal, measure and record the radial clearance, left and right sides, between packing ring and rotor at points 1 and 5 (Fig. 4). The radial clearance should be taken on a short tooth.

6. After ring segment removal, measure and record the tooth height (Figs. 1 and 2) on an 8-point check (Fig. 4). Each segment must be measured at some point on the segment so that the points are equally spaced as shown in Fig. 4.

7. The height measurement can be made to either long or short tooth, whichever comes first from side of segment. Slant tooth and in-line straight tooth rings can be measured in the same manner (Fig. 3).

Test Decision (as required/acc. to specification)	Accepted* / NC-Report*	Rejected* / Rework*	Unit / System Name: Holyrood Generating Station Unit 1
NCR No.*			Part Text: Disassembly clearances; Quantity:
Checked by**: G. Lallon			Part Idnr; Rev.; Power Station Designation
Approved by**: R M Scott			I & T Plan ID; Rev.; Test Step; Material Test No.
Authority / Customer**			Order No.; Factory Order
ALSTOM			Sheet No.: 1; No. of Sh.: 3; Document No.: UTGS 623103; Rev.: -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title

Seal Segment Clearance Measurement

'AS FOUND'

Location	Fig.	Actual Axial (Left)		Actual Axial (Right)		Expected Radial		Actual Radial	
	#	X	Y	X	Y	Left	Right	Left	Right
R1									
R2								.027	.015
R3								.015	.014
R4								.017	.015
R5								.020	.014
R6								.020	.015
R7								.016	.013
R8								.017	.030
R9								.020	.015
R10								.020	.025
R11								.020	.015
R12								.023	.019
R13								.018	.017
R14								.023	.017
R15								.034	.041
R16		.237	.152	.235	.155			.033	.030
R17		.221	.166	.233	.158			.035	.061
R18		.230	.167	.230	.162			.032	.065
R19		.210	.164	.238	.162			.036	.026
R20		.213	.151	.225	.152			.032	.036
R21		.218	.160	.226	.152			.032	.021
R22								.065	.015
R23								.041	.033
R24								.037	.027
R25								.017	.015
R26								.021	.010
R27								.030	.100
R28								.027	.016
R29								.025	.025
R30								.025	.020
R31									
R32									
R33									
R34								.010	.025
R35								.010	.015
R36								.009	.020

Unit / System Name	Order No.	Factory Order
Holyrood Generating Station Unit 1		

ALSTOM		Sheet No.	No. of Sh.	Document No.	Rev.
		2	3	UTGS 623103	-

Test Certificate

Title

Seal Segment Clearance Measurement

'AS FOUND'

R37								.005	.036
R38								.005	.045
R39									.037
R40								.002	.045
R41								.009	.035
R42								.011	.038
R43								.016	.048
R44								.014	.040
R45								.015	.045
R46								.015	.030
R47								.009	.028
R48								.009	.045

Unit / System Name		Order No.		Factory Order	
Holyrood Generating Station Unit 1					
ALSTOM	Sheet No. 3	No. of Sh. 3	Document No. UTGS 623103		Rev. -

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623103	QC	-	2012-05-25	EN	Approved

Test Certificate	Title: Seal Segment Clearance Measurement Instructions

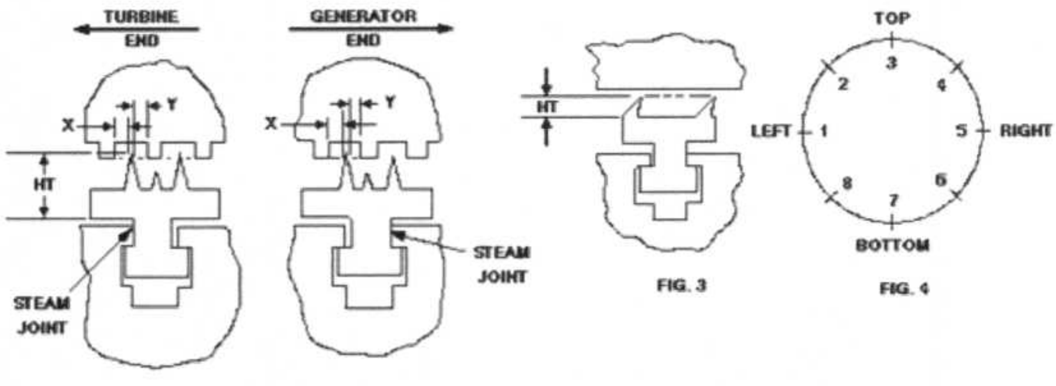


FIG 1. FIG. 2 FIG. 3 FIG. 4

Notes For Checking Packing Clearances

1. Each ring must always be held against the steam seal side of the neck of the packing ring when checking clearances. The packing assembly drawings should be checked to be certain which side of the packing is the steam seal side.

2. The rotor must be blocked away from the generator as far as thrust allows when checking clearances.

3. The "X" clearance is always on the side of the packing long tooth toward the turbine end of the turbine and "Y" is the clearance on the side of the packing long tooth toward the generator. The clearance is the minumum distance at the point measured.

4. The packing assemblies are numbered starting from the turbine end of the machine and working toward the generator. The packing rings in one assembly are also numbered from the turbine end of the assembly working toward the generator. When recording measurements for steam packing, fill in packing and ring column with packing assembly number first, followed by a dash, then the ring number. In this instance the diaphragm stage columns will be left blank. When recording measurements for diaphragm packing, the packing and ring number column will be left blank.

5. Prior to packing segment removal, measure and record the radial clearance, left and right sides, between packing ring and rotor at points 1 and 5 (Fig. 4). The radial clearance should be taken on a short tooth.

6. After ring segment removal, measure and record the tooth height (Figs. 1 and 2) on an 8-point check (Fig. 4). Each segment must be measured at some point on the segment so that the points are equally spaced as shown in Fig. 4.

7. The height measurement can be made to either long or short tooth, whichever comes first from side of segment. Slant tooth and in-line straight tooth rings can be measured in the same manner (Fig. 3).

Test Decision (as required/acc. to specification) — Accepted* / Rejected* / NC-Report* / Rework*	Unit / System Name: Holyrood Generating Station Unit 1
NCR No.*	Part Text: Assembly Clearances — Quantity:
Checked by**: G. Lallon	Part Idnr — Rev. — Power Station Designation
Approved by**: RM Scott	I & T Plan ID — Rev. — Test Step — Material Test No.
Authority / Customer**	Order No. — Factory Order
ALSTOM	Sheet No.: 1 — No. of Sh.: 3 — Document No.: UTGS 623103 — Rev.: -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623103	QC	-	2012-05-25	EN	Approved

Test Certificate

Title

Seal Segment Clearance Measurement

'Final'

Location	Fig.	Expected Axial		Actual Axial		Expected Radial		Actual Radial	
	#	X	Y	X	Y	Left	Right	Left	Right
R1								024	018
R2								028	016
R3								017	016
R4								020	017
R5								020	016
R6								022	016
R7								017	017
R8								017	030
R9								021	216
R10								022	028
R11								022	019
R12								025	020
R13								018	020
R14								024	021
R15								035	040
R16				238	150			033	030
R17				220	170			035	060
R18				230	165			032	065
R19				215	166			036	030
R20				210	150			032	038
R21				220	160			030	026
R22								065	020
R23								041	035
R24								037	030
R25								020	017
R26								021	015
R27								030	100
R28								028	020
R29								025	025
R30								025	020
R31								026	018
R32								022	019
R33								027	020
R34								010	030
R35								015	020
R36								010	020

Unit / System Name	Order No.			Factory Order	
ALSTOM	Sheet No. 2	No. of Sh. 3	Document No.	UTGS 623103	Rev. -

Test Certificate

Title

Seal Segment Clearance Measurement
'Final'

Location	Fig.	Expected Axial		Actual Axial		Expected Radial		Actual Radial	
	#	X	Y	X	Y	Left	Right	Left	Right
R37								010	036
R38								011	044
R39									039
R40								010	045
R41								009	030
R42								015	035
R43								018	048
R44								016	040
R45								015	043
R46								020	030
R47								014	029
R48								011	045

Unit / System Name	Order No.			Factory Order
ALSTOM	Sheet No. 3	No. of Sh. 3	Document No. UTGS 623103	Rev. -

Test Certificate

Title

Journal Bearings

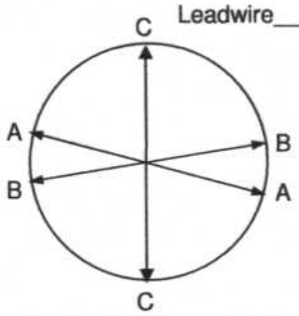
Inspections & Checks	
Ball Contact Check	X,V
Ball Pinch Check	X
Ball Torque Check	N
Twist & Tilt Check	X
Journal Inspection	X
Babbit Inspection	X,UT,V
Screens & Orifices	X
T/C Calib.	

Code	
X	Work Carried Out
N	Not Done
NA	Not Applicable
C	See Comments
V	Visual Inspection
MP	Mag. Particle
UT	Ultrasonic
PT	Penetrant

Bearing No.	Bearing Type	Turbine End A-Dia	Turbine End B-Dia	Turbine End C-Dia	Generator End A-Dia	Generator End B-Dia	Generator End C-Dia	Journal Dia.	Vertical Clearance Mils	Vertical Clearance Mils/In
1	EL	8.014	8.015	8.010	8.014	8.015	8.0105	7.9985	.0115	1.44
2	EL	15.036	15.037	15.023	15.038	15.037	15.024	14.999	.024	1.6
3	EL	13.036	13.037	13.014	13.038	13.038	13.015	12.998	.016	1.2
4	EL	13.028	13.026	13.015	13.031	13.027	13.018	12.9985	.0165	1.27
5	EL	13.028	13.031	13.018	13.026	13.030	13.016	12.998	.018	1.4

Shim__________

Leadwire__________



Ball Seat Pinch Fits			
Bearing Number	Pinch* Mils	Bearing Number	Pinch *
T1	.002		
T2	,002		
T3	,002		
T4	.0005		
T5	,0005		

*Pinch equals wire thickness minus shim

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: Holyrood Generating Station Unit 1
	NC-Report*		Rework*		

NCR No.*

Part Text: Journal Bearing Dimensionals

Quantity

Checked by**: B. Corcoran

Part Idnr — Rev. — Power Station Designation

Approved by**: R M Scott

I & T Plan ID — Rev. — Test Step — Material Test No.

Authority / Customer**

Order No. — Factory Order

ALSTOM

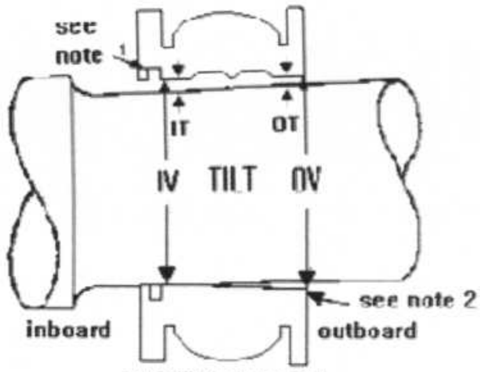
Sheet No.	No. of Sh.	Document No.	Rev.
1	2	UTGS 623092	-

* Mark/Fill in if applicable ** Name / dept. / date / initials

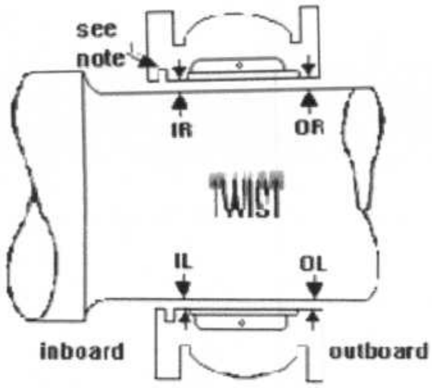
Test Certificate

Title

Bearing To Journal Alignment (For Bearings With Ball Seats)



ELEVATION VIEW



PLAN VIEW

NOTES:

1. On most generator bearings, the end leakage groove is on the outboard end
2. On hood bearings, the outboard end is set low to compensate for vacuum deflection

Tilt													
Bearing Number	OV	IV	OT	IT	Limits	Actual	Bearing Number	OV	IV	OT	IT	Limits	Actual
1			.009	.010			7						
2			.022	.023			8						
3			.021^{5}	.022			9						
4			.018	.018			10						
5			.019	.019			11						
6							12						

Twist (Initial)							Twist (Recheck)						
Bearing Number	OL	IL	IR	OR	Limits	Actual	Bearing Number	OL	IL	IR	OR	Limits	Actual
1	.008	.008	.011	.010			7						
2	.014	.015	.015	.015			8						
3	.016	.019	.018	.016			9						
4	.010	.012	.012	.013			10						
5	.015	.011	.013	.012			11						
6							12						

Unit / System Name	Order No.			Factory Order	
ALSTOM	Sheet No. 2	No. of Sh. 2	Document No.	UTGS 623092	Rev. -

Dept.	Document No.	Type	Rev	Released	Lng.	Status
6105	UTGS623108	QC	-	2012-05-25	EN	Approved

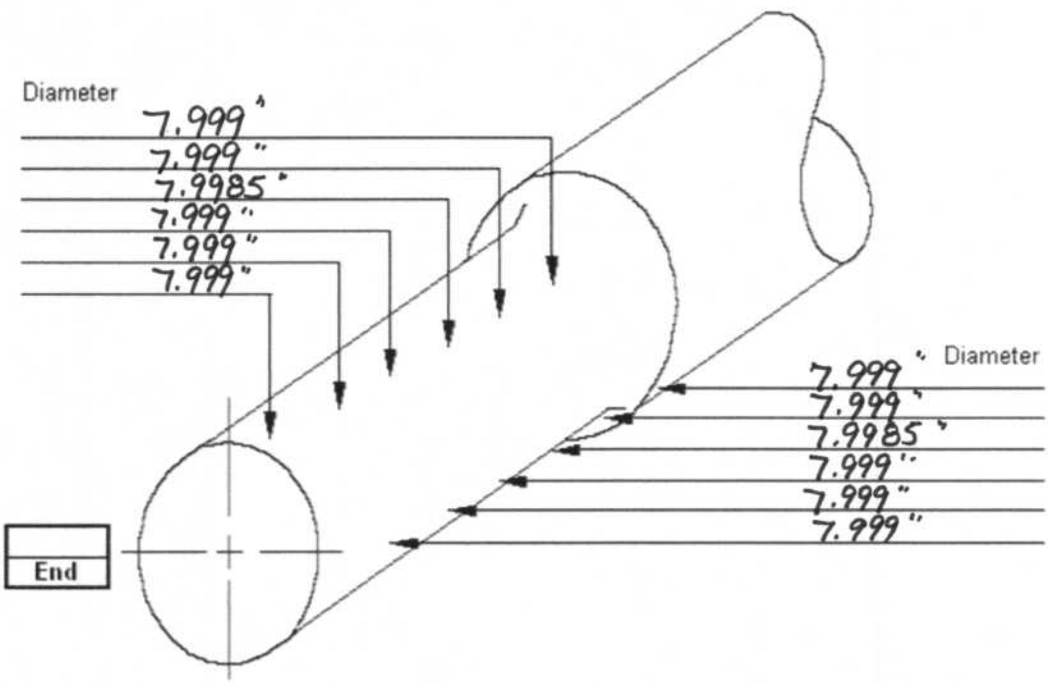
Test Certificate

Title

Rotor Journal Condition

Journal #: T1

Note: Mark on sketch to show grooving, discoloration, carbon inclusions, or irregularities in the journal surface.



	0°	90°
Maximum		
Minimum		
Difference		
Average		

Out of Roundness

Diameter 0°	Diameter 90°	Out of Round

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name	T1 Journal
	NC-Report*		Rework*			
NCR No.*					Part Text	Quantity
Checked by**					Part Idnr / Rev.	Power Station Designation
Approved by** Ray Scott					I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.	Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 1	Document No. UTGS 623108 / Rev. -

* Mark/Fill in if applicable ** Name / dept. / date / initials

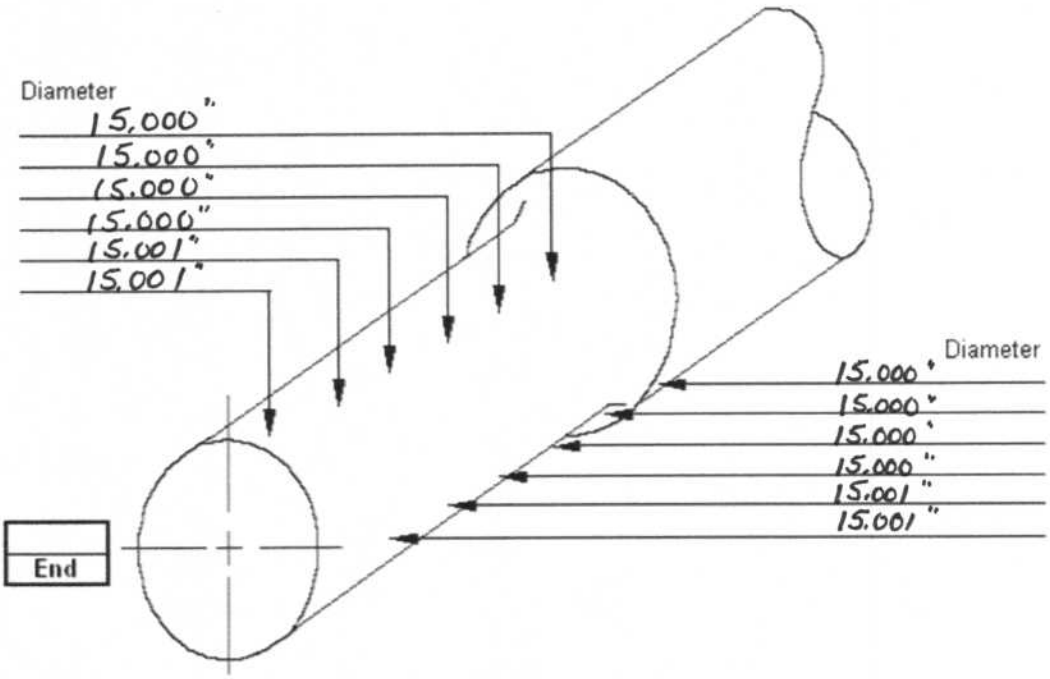
Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623108	QC	-	2012-05-25	EN	Approved

Test Certificate

Title: **Rotor Journal Condition**

Journal #: T2

Note: Mark on sketch to show grooving, discoloration, carbon inclusions, or irregularities in the journal surface.



	0°	90°
Maximum		
Minimum		
Difference		
Average		

Out of Roundness

Diameter 0°	Diameter 90°	Out of Round

Test Decision (as required/acc. to specification)	Accepted*		Rejected*	
	NC-Report*		Rework*	

Unit / System Name: T2 Journal

NCR No.*:

Part Text:

Quantity:

Checked by**: B. Corcoran

Part Idnr:

Rev.:

Power Station Designation:

Approved by**: RM Scott

I & T Plan ID:

Rev.:

Test Step:

Material Test No.:

Authority / Customer**:

Order No.:

Factory Order:

ALSTOM

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1	1	UTGS 623108	-

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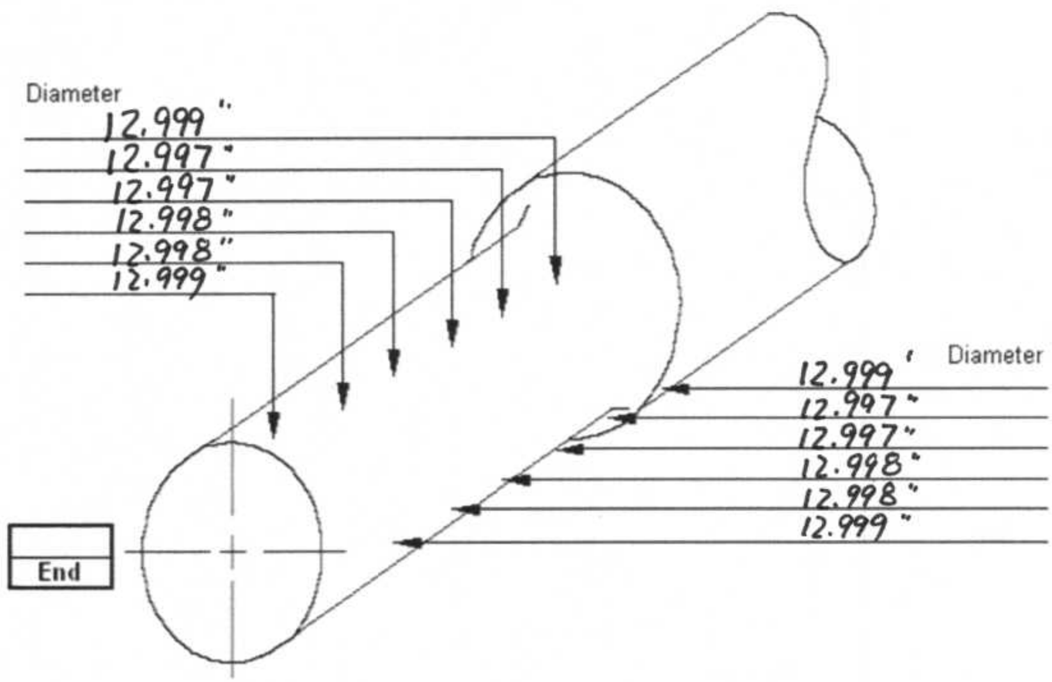
Dept.	Document No.	Type	Rev	Released	Lng.	Status
6105	UTGS623108	QC	-	2012-05-25	EN	Approved

Test Certificate

Title: **Rotor Journal Condition**

Journal #: T3

Note: Mark on sketch to show grooving, discoloration, carbon inclusions, or irregularities in the journal surface.



	0°	90°
Maximum		
Minimum		
Difference		
Average		

Out of Roundness

Diameter		Out of Round
0°	90°	

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: T3 Journal		
	NC-Report*		Rework*				
NCR No.*					Part Text		Quantity
Checked by**: B. Corcoran					Part Idnr	Rev.	Power Station Designation
Approved by**: R M Scott					I & T Plan ID	Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.		Factory Order
ALSTOM					Sheet No.: 1	No. of Sh.: 1	Document No.: UTGS 623108 / Rev.: -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623108	QC	-	2012-05-25	EN	Approved

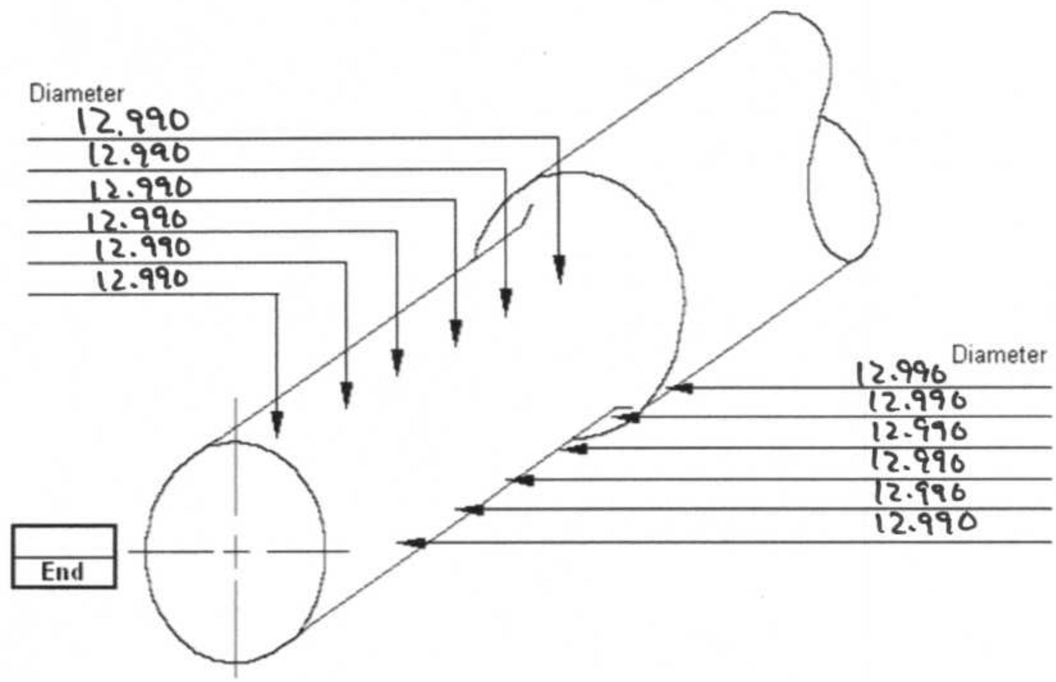
Test Certificate

Title

Rotor Journal Condition

Journal #: T4

Note: Mark on sketch to show grooving, discoloration, carbon inclusions, or irregularities in the journal surface.



	0°	90°
Maximum	12.990	12.996
Minimum	12.990	12.996
Difference	—	—
Average	12990	12.990

Out of Roundness

Diameter 0°	Diameter 90°	Out of Round

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: Journal T4 Generator Rotor	
	NC-Report*		Rework*			
NCR No.*					Part Text	Quantity
Checked by**: G. Halon					Part Idnr / Rev.	Power Station Designation
Approved by**: R. Scott					I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.	Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 1 / Document No. UTGS 623108	Rev. -

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623108	QC	-	2012-05-25	EN	Approved

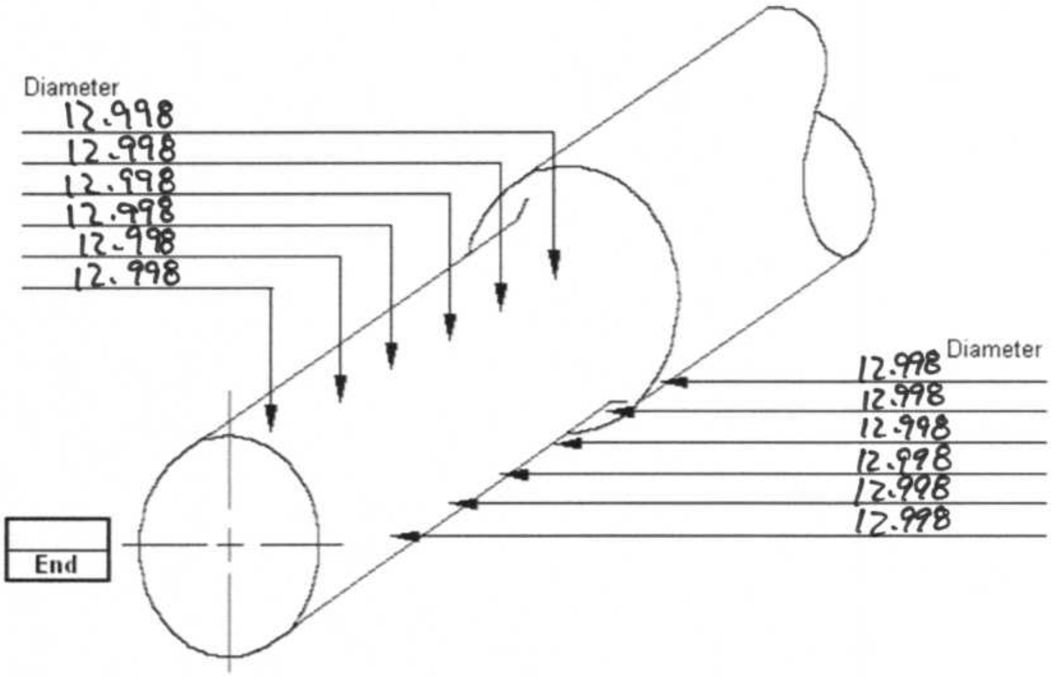
Test Certificate

Title

Rotor Journal Condition

Journal #: T5

Note: Mark on sketch to show grooving, discoloration, carbon inclusions, or irregularities in the journal surface.



	0°	90°
Maximum	12.998	12.998
Minimum	12.998	12.998
Difference	—	—
Average	12.998	12.998

Out of Roundness

Diameter 0°	Diameter 90°	Out of Round

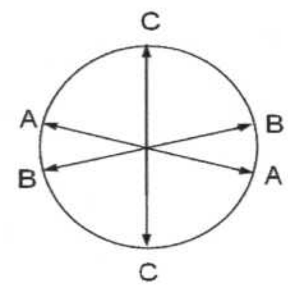
Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: Journal T5 Generator Rotor	
	NC-Report*		Rework*			
NCR No.*					Part Text	Quantity
Checked by**: G. Lallon					Part Idnr / Rev.	Power Station Designation
Approved by**: R Scott					I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.	Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 1	Document No. UTGS 623108 / Rev. -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title: **Oil Deflector Clearance**

INSPECTIONS & CHECKS				CODE	
Teeth Inspected	X, V			X	Work Carried Out
Journals Inspected	X, V			N	Not Done
				NA	Not Applicable
				C	See Comments
				V	Visual Inspection
				MP	Mag. Particle
				UT	Ultrasonic
				PT	Penetrant



Location Number	Oil Deflector A-Dia	Oil Deflector B-Dia	Oil Deflector C-Dia	Journal Dia	Clearance Average	Clearance Min.	Clearance Max.	Condition Comment
T1	12.017	12.020	12.021	11.996	.023	.021	.025	ok
	12.017	12.021	12.021	11.996	.023	.021	.025	
T2 HP	15.020	15.019	15.045	14.999	.033	.020	.046	OK
	15.018	15.019	15.052	14.999	.036	.0195	.053	
T2 LP	15.031	15.025	15.038	14.999	.034	.029	.039	OK
	15.019	15.038	15.032	14.999	.031	.029	.033	
T3 HP	14.029	14.032	14.050	13.999	.041	.031	.051	OK
	14.031	14.026	14.0455	13.999	.038	.029	.046	
T3 LP	14.032	14.033	14.033	13.999	.033	.033	.033	OK
	14.032	14.033	14.037	13.999	.036	.033	.038	

Test Decision (as required/acc. to specification): Accepted* / Rejected* / NC-Report* / Rework*

Unit / System Name: Holyrood Generating Station Unit 1

NCR No.*

Part Text: Oil Deflectors

Quantity:

Checked by**: B. Corcoran

Part Idnr: Rev.: Power Station Designation:

Approved by**: RM Scott

I & T Plan ID: Rev.: Test Step: Material Test No.:

Authority / Customer**

Order No.: Factory Order:

ALSTOM

Sheet No.	No. of Sh.	Document No.	Rev.
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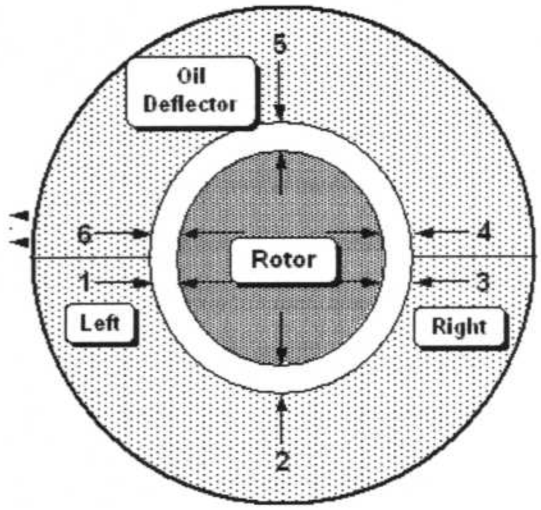
Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623094	QC	-	2012-05-25	EN	Approved

Test Certificate

Title

Oil Deflector Alignment

"ASSEMBLED"



Location	Position (Mils) 1	2	3	4	5	6	Clearance Median	Min.	Max	Ideal Position Top	Bottom	Sides
T1	.012	.005	.012	.012	.020	.012						
T2 IN	.010	.007	.010	.010	.030	.010						
T2 OUT	.018	.006	.018	.018	.032	.018						
T3 IN	.020	.006	.016	.016	.031	.020						
T3 OUT	.014	.006	.014	.014	.030	.014						
T4 IN	.020	.010	.017	.017	.022	.020						
T4 OUT	.012	.010	.012	.012	.024	.012						
T5 IN	.014	.006	.013	.013	.022	.014						
T5 OUT	.010	.007	.010	.010	.020	.010						

Unit / System Name	Order No.		Factory Order	
Oil Deflectors				
ALSTOM	Sheet No. 2	No. of Sh. 2	Document No. UTGS 623094	Rev. -

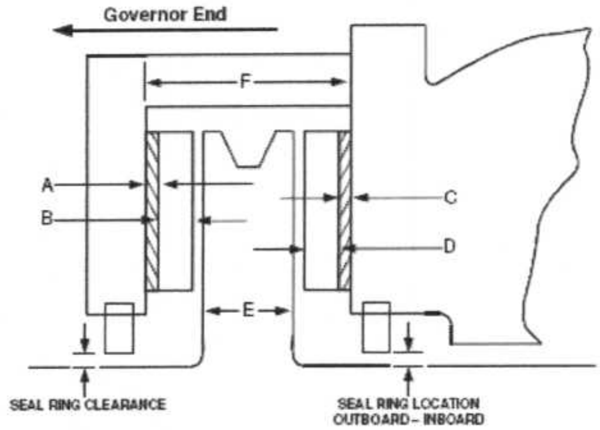
Test Certificate

Title

Thrust Bearing Overhung

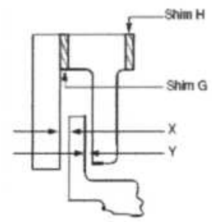
INSPECTION & CHECKS				CODE	
Ball Contact Check	X,V	Check Threads on Rotor	NA	X	Work Carried Out
Ball Pinch Check	X,V	Babbitt Inspection	X.V,UT	N	Not Done
Ball Torque Check	N	Runner Inspection	X,V	NA	Not Applicable
Parallelism Check	X,V	Wear Device Inspection	X,V	C	See Comments
Thrust Plate Inspection	X,V,UT	Screens and Orifices	X,V	V	Visual Inspection
Collar to Shaft Fit	X,V	Thermocouples Calib.	N	MP	Mag. Particle
Check Thrust	X,V	Seal Ring	X.V	UT	Ultrasonic
Nut Torque	NA			PT	Penetrant

Thrust Bearing Data	
"A" Shim	.261
"B" Plate	.756
"C" Shim	.225
"D" Plate	.750
"E" Runner	3.998
"T" Total	5.990
"F" Casing	6.004
"T" Total	5.990
Clearance (F minus T)	.014
Clearance (By float)	.013



Wear Device N/A	
"H" Shim	
X	
Y	

Ball	
Torque	Ft-Lb



Location	Inboard		Outboard	
	0°	90°	0°	90°
Ring ID				
Journal OD				
Clearance				

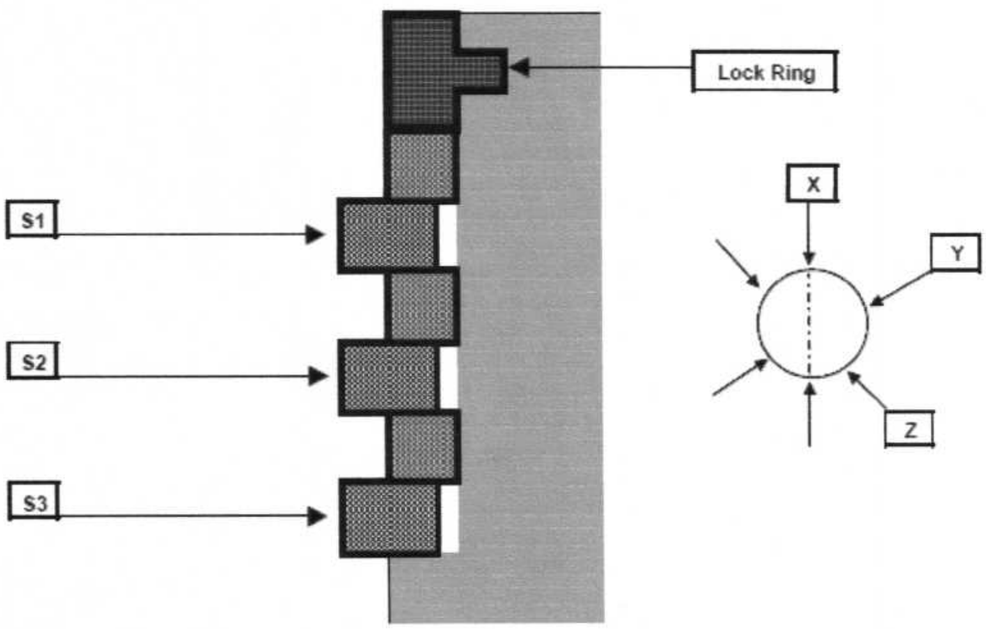
Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: Holyrood Generating Station Unit 1
	NC-Report*		Rework*		
NCR No.*					Part Text: Thrust Bearing; Quantity:
Checked by**: B. Corcoran					Part Idnr; Rev.; Power Station Designation
Approved by**: RM Scott					I & T Plan ID; Rev.; Test Step; Material Test No.
Authority / Customer**					Order No.; Factory Order
ALSTOM					Sheet No.: 1; No. of Sh.: 3; Document No.: UTGS 623093; Rev.: -

* Mark/Fill in if applicable ** Name / dept. / date / initials

ALSTOM RECORD SHEET Stripdown / Build Page 2

Title	**CV Snout Pipes and Snout Rings**				
Contract	**Holyrood Generating Station**	Unit	**Unit 1**	Serial No.	**0940310**
Site Issue	**Issue 1** Date	Checked		Check List No.	
Taken by	Date	Supvr. G. Lallon	Approv. R Scott	Date	

Ref. Drawing: -

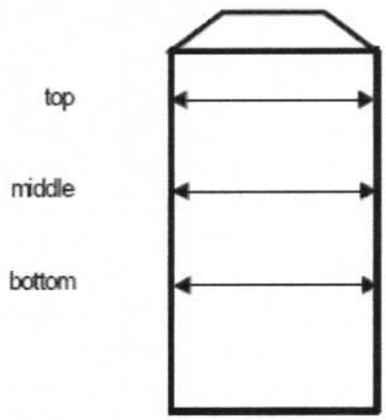


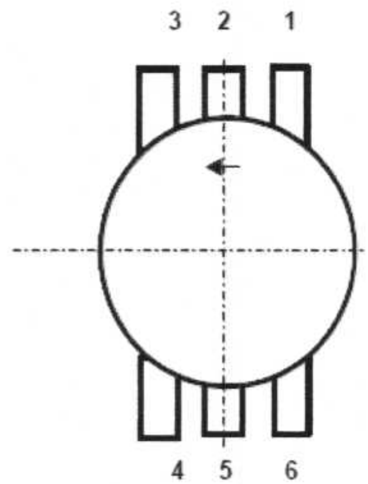
Locations		Inner Diameters			
Valve		X	Y	Z	Average
1	Inner seal ring (S1)	5.599	5.606	5.607	5.602
	Inner seal ring (S2)	5.600	5.603	5.607	5.603
	Inner seal ring (S3)	5.604	5.603	5.601	5.602
2	Inner seal ring (S1)	5.592	5.596	5.596	5.595
	Inner seal ring (S2)	5.591	5.596	5.600	5.595
	Inner seal ring (S3)	5.595	5.596	5.604	5.598
3	Inner seal ring (S1)	5.623	5.626	5.627	5.625
	Inner seal ring (S2)	5.623	5.630	5.629	5.627
	Inner seal ring (S3)	5.623	5.632	5.635	5.630

ALSTOM RECORD SHEET **Stripdown / Build** Page 1

Title	**CV Snout Pipes and Snout Rings**				
Contract	**Holyrood Generating Station**	Unit	**Unit 1**	Serial No.	**0940310**
Site Issue	**Issue 1** Date	Checked		Check List No.	
Taken by	Date	Supvr. G. Lallon		Approv. R Scott	Date

Ref. Drawing: -





Final diameters of the Control Valve Snout Pipe and Clearances at the Snout Rings									
	Valve #1			**Valve #2**			**Valve #3**		
	Inner Ring Diameter			**Inner Ring Diameter**			**Inner Ring Diameter**		
	Axial	**Across**	**Final**	**Axial**	**Across**	**Final**	**Axial**	**Across**	**Final**
Top	5.601	5.599	5.600	5.595	5.591	5.593	5.627	5.619	5.623
Middle	5.600	5.599	5.599	5.597	5.591	5.594	5.628	5.619	5.623^{5}
Bottom	5.600	5.598	5.599	5.597	5.592	5.594^{5}	5.626	5.620	5.623

Comments

Dept.	Document No.	Type	Rev	Released	Lng.	Status
6105	UTGS623095	QC	-	2012-05-25	EN	Approved

Test Certificate

Title: **Turning Gear Inspection**

INSPECTIONS & CHECKS				CODE	
Turning gear body	V			X	Work Carried Out
Turning gear wheels	V			N	Not Done
Turning gear bearings	V			NA	Not Applicable
Turning gear chain	V			C	See Comments
				V	Visual Inspection
				MP	Mag. Particle
				UT	Ultrasonic
				PT	Penetrant

Bushing ID______
Shaft OD______
Clearance Ø

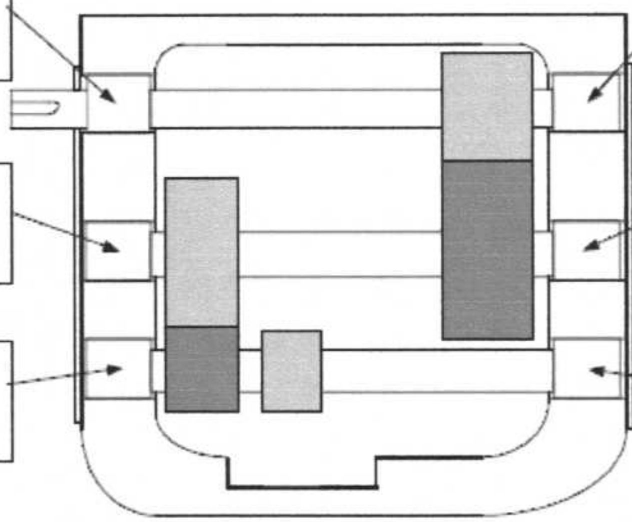
Bushing ID______
Shaft OD______
Clearance Ø

Bushing ID______
Shaft OD______
Clearance Ø

Bushing ID______
Shaft OD______
Clearance Ø

Bushing ID______
Shaft OD______
Clearance Ø

Bushing ID______
Shaft OD______
Clearance Ø



ID Bearing TE______
Shaft OD______
Clearance Ø

Shaft with the big wheel and the clutch

ID Bearing GE______
Shaft OD______
Clearance Ø

T/G not disassembled. Visual Inspection Only.
All Shaft End Play less than .002"
Main Gear Backlash .065"
All Gears have Good Contact Pattern

Test Decision (as required/acc. to specification) Accepted* / Rejected* / NC-Report* / Rework*	Unit / System Name: Holyrood Generating Station Unit 1	
NCR No.*	Part Text: Turning Gear	Quantity
Checked by**: G. Lallary	Part Idnr / Rev.	Power Station Designation
Approved by**: R M Scott	I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**	Order No.	Factory Order
ALSTOM	Sheet No. 1 / No. of Sh. 1 / Document No. UTGS 623095	Rev. -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title: **Oil pump Inspection**

AOP #1

INSPECTIONS & CHECKS			
Impeller Inspection	V	Bearing Inspection	X,V
Wear Ring Inspection	X,V	Coupling Checked	X,V
Coupling Inspection	V		

CODE	
X	Work Carried Out
N	Not Done
NA	Not Applicable
C	See Comments
V	Visual Inspection
MP	Mag. Particle
UT	Ultrasonic
PT	Penetrant

TYPE: AC (TGOP, MSP, EBOP, etc.)

DATA: Final (As Found/Final)

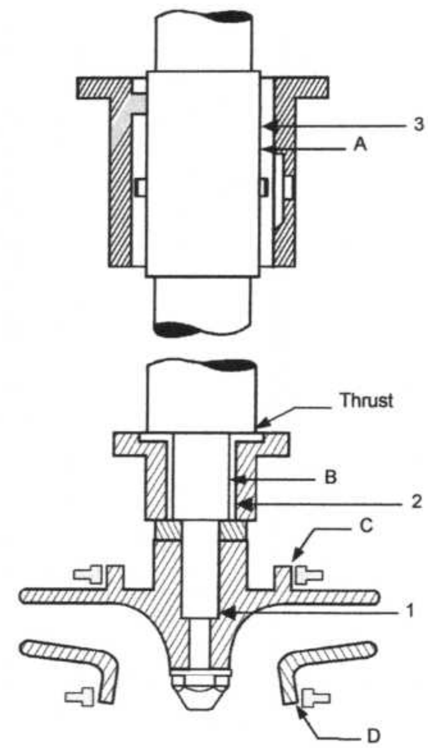
BEARING RING CLEARANCE

	#B	#A
Bearing ID	1.752"	
Journal OD	1.747"	
Clearance	.005"	
Thrust - as found		
Thrust - final, as left	.004"	

WEAR RING CLEARANCE

	C	D
Wear Ring ID	3.133"	2.886"
Impeller OD	3.113"	2.865"
Clearance	.021"	.021"

	1	2	3
Runout	.003	.000	.000



Replaced Upper Bearing
" Upper Oil Seal
" Lower Oil Seal

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: Holyrood Generating Station Unit 1		
	NC-Report*		Rework*				
NCR No.*					Part Text: Auxiliary Oil Pump 1		Quantity
Checked by**: B. Corcoran					Part Idnr	Rev.	Power Station Designation
Approved by**: RM Scott					I & T Plan ID	Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.		Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 1	Document No. UTGS 623113	Rev. -

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Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623113	QC	-	2012-05-25	EN	Approved

Test Certificate

Title
Oil pump Inspection
AOP #2

INSPECTIONS & CHECKS				CODE	
Impeller Inspection	V	Bearing Inspection	X,V	X	Work Carried Out
Wear Ring Inspection	X,V	Coupling Checked	X,V	N	Not Done
Coupling Inspection	V			NA	Not Applicable
				C	See Comments
				V	Visual Inspection
				MP	Mag. Particle
				UT	Ultrasonic
				PT	Penetrant

TYPE: AC
(TGOP, MSP, EBOP, etc.)

DATA: Final
(As Found/Final)

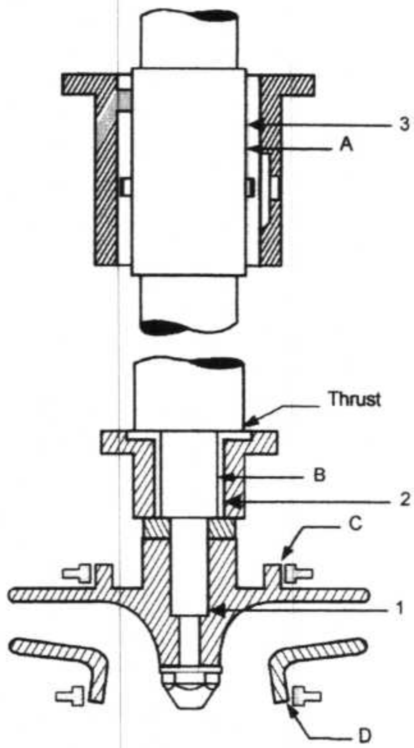
BEARING RING CLEARANCE

	A	B
Bearing ID		1.752"
Journal OD		1.747"
Clearance		.005"
Thrust - as found		
Thrust - final, as left		.004"

WEAR RING CLEARANCE

	C	D
Wear Ring ID	3.134"	2.887"
Impeller OD	3.113"	2.865"
Clearance	.021"	.022"

	1	2	3
Runout	0	0	0



NEW Shaft
NEW Nut
Replaced Upper Bearing
" Upper Oil Seal
" Lower Oil Seal

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: Holyrood Generating Station Unit 1	
	NC-Report*		Rework*			
NCR No.*					Part Text: Auxiliary Oil Pump 2	Quantity
Checked by**: B. Corcoran					Part Idnr / Rev.	Power Station Designation
Approved by**: R M Scott					I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.	Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 1 / Document No. UTGS 623113	Rev. -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623113	QC	-	2012-05-25	EN	Approved

Dept.	Document No.	Type	Rev	Released	Lng.	Status
6105	UTGS623113	QC	-	2012-05-25	EN	Approved

Test Certificate

Title: **Oil pump Inspection**
DC Pump

INSPECTIONS & CHECKS			
Impeller Inspection	V	Bearing Inspection	X,V
Wear Ring Inspection	X,V	Coupling Checked	X,V
Coupling Inspection	V		

CODE	
X	Work Carried Out
N	Not Done
NA	Not Applicable
C	See Comments
V	Visual Inspection
MP	Mag. Particle
UT	Ultrasonic
PT	Penetrant

TYPE: DC (TGOP, MSP, EBOP, etc.)

DATA: Final (As Found/Final)

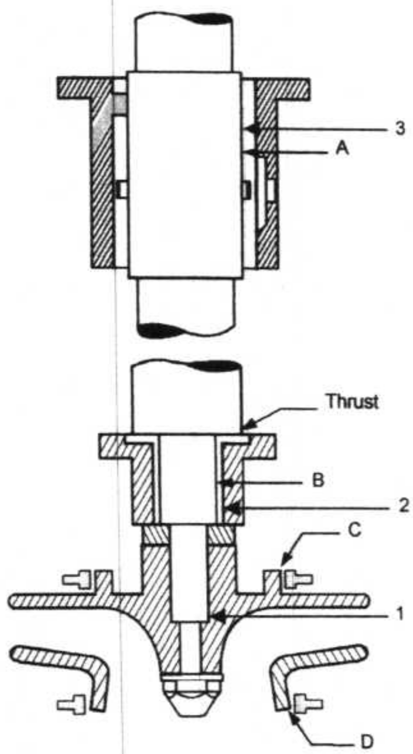
BEARING RING CLEARANCE

	A	B
Bearing ID		1.755"
Journal OD		1.749"
Clearance		.006"
Thrust - as found		
Thrust - final, as left		.008"

WEAR RING CLEARANCE

	C	D
Wear Ring ID	3.132"	2.884"
Impeller OD	3.115"	2.869"
Clearance	.017"	.015"

	1	2	3
Runout	1.5	1.0	1.0



Test Decision (as required/acc. to specification)	Accepted*		Rejected*	
	NC-Report*		Rework*	

Unit / System Name: Holyrood Generating Station Unit 1

NCR No.*:

Part Text*: EBOP

Quantity:

Checked by**: B. Corcoran

Part Idnr:

Rev.:

Power Station Designation:

Approved by**: RM Scott

I & T Plan ID:

Rev.:

Test Step:

Material Test No.:

Authority / Customer**:

Order No.:

Factory Order:

ALSTOM

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1	1	UTGS 623113	-

* Mark/Fill in if applicable ** Name / dept. / date / initials

Dept.	Document No.	Type	Rev	Released	Lng.	Status
6105	UTGS623106	QC	-	2012-05-25	EN	Approved

Test Certificate

Title

Turbine Rotor Inspection Checklist

Number of Stages______________

Solid ☑ Built Up ☐

CODE		
X - Work Carried Out	C - See Comments	UT - Ultrasonic
N - Not Done	V - Visual Inspection	PT - Penetrant
NA - Not Applicable	MP - Mag. Particle	

Inspection & Checks

Check Rotor Bow	N	Insp. Tie Wires	V, MP
Remove Deposit Sample	N	Insp. Wheel Faces	V, MP
Check Ph of Deposit	N	Insp. Wheel Radii	V, MP
Blast Clean	X	Insp. Water Impeller(s)	NA
Rotor Test Inspections	V, MP	Insp. Impeller Casing(s)	NA
- Buckets	V, MP	Insp. Slinger(s)	NA
- Bore	N	Insp. Bore Plug	N
- Dovetails	N	Insp. Journals	X, V
- Peripherals	V, MP	Insp. Cplg. Rabbet(s)	X, V
- Dovetail Pins	V, MP	Insp. Cplg. Faces	X, V
- Erosion Shields	V, MP	Insp. Cplg. Bolt Holes	X, V
Insp. Bkt. Covers	V, MP	Insp. Stm Balance Holes	V
Insp. Bucket Tenions	V, MP	- In Buckets	
Insp. Bkt. Vanes, Roots	V, MP	- In Wheels	
Backs		Insp. Solid Particle Erosion	V
Insp. Balance Holes	V	Insp. for Water Induction	V
Grooves	V		
Insp. Heat Grooves	V		
Insp. Notch Blocks	V		
Insp. Packing Grooves	V		

Comments: Rotor was found to be in good condition. Evidence of previous FOD and FOD Repairs on Stages 1,2,3 HP

Test Decision (as required/acc. to specification)	Accepted* ☐ NC-Report* ☐	Rejected* ☐ Rework* ☐	Unit / System Name: Holyrood Generating Station Unit 1	
NCR No.*			Part Text: HP/IP/LP Turbine Rotor	Quantity
Checked by**: TEAM & RM Scott			Part Idnr / Rev.	Power Station Designation
Approved by**: RM Scott			I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**			Order No.	Factory Order
ALSTOM			Sheet No. 1 / No. of Sh. 1	Document No. UTGS 623106 / Rev. -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Outer Shell Bolting						
Stud Number		Overall Length		Diameter		Req. stretch by flats
1		18.26		3.5		1-1/2
2		18.26		3.5		1-1/2
3		18.26		3.5		1-1/2
4		18.26		3.5		1-1/2
5		18.26		3.5		1-1/2
6		18.26		3.5		1-1/2
7		18.26		3.5		1-1/2
8		18.26		3.5		1-1/2
9		19.26		4.0		1-1/2
10		19.26		4.0		1-1/2
11		19.26		4.0		1-1/2
12		19.26		4.0		1-1/2
13		22		4.5		1-5/8
14		22		4.5		1-5/8
15		22.75		4.5		1-5/8
16		22.75		4.5		1-5/8
17		22.75		4.5		1-5/8
18		22.75		4.5		1-5/8
19		22.75		4.5		1-5/8
20		22.75		4.5		1-5/8
21		22.75		4.5		1-5/8
22		22.75		4.5		1-5/8
23		22.75		4.5		1-5/8
24		22.75		4.5		1-5/8
25		22.75		4.5		1-5/8
26		22.75		4.5		1-5/8
27		22.75		4.5		1-5/8
28		22.75		4.5		1-5/8
29		22.75		4.5		1-5/8
30		22.75		4.5		1-5/8
31		22.75		4.5		1-5/8
32		22.75		4.5		1-5/8
33		22.75		4.5		1-5/8
34		22.75		4.5		1-5/8
35		20.75		4.5		1-1/2
36		20.75		4.5		1-1/2
37		20.75		4.5		1-1/2
38		20.75		4.5		1-1/2
39		20.75		4.5		1-1/2
40		20.75		4.5		1-1/2

Outer Shell Bolting						
Stud Number		Overall Length		Diameter		Req. stretch by flats
41		15		3.5		1-1/4
42		15		3.5		1-1/4
43		10.76		2.0		1
44		10.76		2.0		1
45		9.5		2.0		7/8
46		9.5		2.0		7/8
47		9.5		2.0		7/8
48		9.5		2.0		7/8
49		14.25		2.0		1-1/4
50		14.25		2.0		1-1/4
51		14.25		2.0		1-1/4
52		14.25		2.0		1-1/4
53		14.25		2.0		1-1/4
54		14.25		2.0		1-1/4
55		14.25		2.0		1-1/4
56		14.25		2.0		1-1/4
57		14.25		2.0		1-1/4
58		14.25		2.0		1-1/4
59		14.25		2.0		1-1/4
60		14.25		2.0		1-1/4
61		9.75		2.0		1
62		9.75		2.0		1
63		9.75		2.0		1
64		9.75		2.0		1
65		9.75		2.0		1
66		9.75		2.0		1
67		9.75		2.0		1
68		9.75		2.0		1
69		9.75		2.0		1
70		9.75		2.0		1
71		9.75		2.0		1
72		9.75		2.0		1
73		9.75		2.0		1
74		9.75		2.0		1
75		9.75		2.0		1
76		9.75		2.0		1
77		10.25		2.25		1
78		10.25		2.25		1
79		10.25		2.25		1
80		10.25		2.25		1

Inner cylinder Studs						
Stud Number		Overall Length		Diameter		Req. stretch by flats
81		14.25		2.5		1-1/4
82		14.25		2.5		1-1/4
83		14.75		2.8		1-1/4
84		14.74		2.8		1-1/4
85		18.875		3.0		1-1/2
86		18.875		3.0		1-1/2
87		18.875		3.0		1-1/2
88		18.875		3.0		1-1/2
89		19.75		4.0		1-1/2
90		19.75		4.0		1-1/2
91		22.5		4.0		1-3/4
92		22.5		4.0		1-3/4
93		22.5		4.0		1-3/4
94		22.5		4.0		1-3/4
95		22.5		4.0		1-3/4
96		22.5		4.0		1-3/4
97		22.5		4.0		1-3/4
98		22.5		4.0		1-3/4
99		22.5		4.0		1-3/4
100		22.5		4.0		1-3/4
101		19.5		3.5		1-1/2
102		19.5		3.5		1-1/2
103		19.5		3.5		1-1/2
104		19.5		3.5		1-1/2

Outer Shell Bolting - Internal accessed thru Crossover						
Stud Number		Overall Length		Diameter		Req. stretch by flats
105		9.75		2.0		7/8
106		9.75		2.0		7/8
107		9.75		2.0		7/8
108		9.75		2.0		7/8
109		9.75		2.0		7/8
110		9.75		2.0		7/8
111		9.75		2.0		7/8
112		9.75		2.0		7/8
113		9.75		2.0		7/8
114		9.75		2.0		7/8
115		9.75		2.0		7/8
116		9.75		2.0		7/8

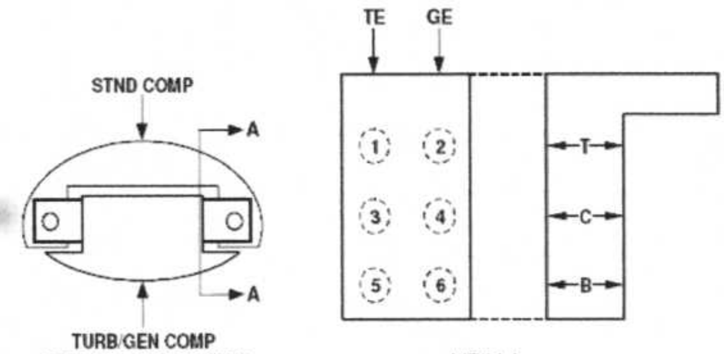
Test Certificate

Title

Centerline Key

"ASSEMBLED"

INSPECTIONS & CHECKS			CODE	
Measure Keys	X		X	Work Carried Out
			N	Not Done
			NA	Not Applicable



CENTERLINE KEY ASSEMBLY

VIEW A-A

Notes: Enter key location as #1 Standard - HP, etc.
Data in inches.

Key Location TURBINE END							
Location	Key-way Data		Key Data		Clearance		Comments
	L/S	R/S	L/S	R/S	L/S	R/S	
1 (T)					.002	.004	LP
2 (T)					.002	.004	
3 (C)					.002	.004	
4 (C)					.002	.004	
5 (B)					.002	.004	
6 (B)					.002	.004	

Key Location GENERATOR END							
Location	Key-way Data		Key Data		Clearance		Comments
	L/S	R/S	L/S	R/S	L/S	R/S	
1 (T)					.002	.002	LP
2 (T)					.002	.002	
3 (C)					.002	.002	
4 (C)					.002	.002	
5 (B)					.002	.002	
6 (B)					.002	.002	

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623098	QC	-	2012-05-25	EN	Approved

Test Decision (as required/acc. to specification)

Accepted*		Rejected*	
NC-Report*		Rework*	

Unit / System Name: Holyrood Generating Station Unit 1

NCR No.*:

Part Text: LP Keys

Quantity:

Checked by**: G. Lallor

Part Idnr:

Rev.:

Power Station Designation:

Approved by**: Pm Scott

I & T Plan ID:

Rev.:

Test Step:

Material Test No.:

Authority / Customer**:

Order No.:

Factory Order:

ALSTOM

Sheet No.	No. of Sh.	Document No.	Rev.
1	1	UTGS 623098	-

* Mark/Fill in if applicable ** Name / dept. / date / initials

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR #STM-001
Subject: Packing Springs for Steam Packing Rows 31, 32		Sheet 1/2 ISSUE #
Station: Holyrood GS	Unit # 1	ALSTOM Conformity: Yes ☐ No X Design Response Required: Yes ☐ No X Design Accepted: Yes ☐ No X
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP X LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☐ Gen. Rotor ☐ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number: 940310	Attachments; # PICTURES # RECORD SHEETS	
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐ Signature: Date:
Programme Reference:		
Quality Plan Reference:		

SITE INSPECTION

Report

Found Lower half gland packing segments with springs missing. Row 31 and Row 32 were missing lower packing springs, row 31 had 3 missing and row 32 had 1 missing.

Recommendations

Borescope packing leak-off lines to determine if they are down the steam line. Install new packing springs at re-assembly of the unit.

Schedule Impact Yes ☐ No X

Cost Impact Yes X No ☐

The cost impact would be the cost of the new springs

Alstom's Engineering Department Recommendations

No disposition required. Replace the springs

Customer's Response

Written By:		Position:	Date:
Distribution For Action:	Client ☐	Engineering ☐	Project Manager ☐
Distribution For Information:	Client ☐	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR #STM-001
Subject: Packing Springs for Steam Packing Rows 31, 32		Sheet 2/2 ISSUE #
Station: Holyrood GS	Unit # 1	ALSTOM Conformity: Yes ☐ No X Design Response Required: Yes ☐ No X Design Accepted: Yes ☐ No X
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP X LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☐ Gen. Rotor ☐ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number: 940310	Attachments; # PICTURES # RECORD SHEETS	
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐ Signature: Date:
Programme Reference:		
Quality Plan Reference:		

No Pictures or Data Sheets

Written By:		Position:	Date:
Distribution For Action:	Client ☐	Engineering ☐	Project Manager ☐
Distribution For Information:	Client ☐	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR #STM-002
Subject: HP Turbine Rotor Stage 1 – 3 HP Section. Minor Foreign Object Damage (FOD).		Sheet 1/2 ISSUE #

Station: Holyrood GS	Unit # 1	ALSTOM Conformity: Yes ☐ No X Design Response Required: Yes ☐ No X Design Accepted: Yes ☐ No X
Component Inspected: Casing ☐ Rotor X HP X IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☐ Gen. Rotor ☐ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number: 940310	Attachments; (1)PICTURES # RECORD SHEETS	
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Programme Reference:		
Quality Plan Reference:		Signature: Date:

SITE INSPECTION

Report

Evidence of minor Foreign Object Damage (FOD) to the first 3 stages of the HP section (rows 1,2,3). In reviewing the previous reports, FOD was found and repaired at previous inspections). This appears "not" to be new FOD.

Recommendations

Blast Clean and NDE areas. Blend and Polish as required to remove any indications or high spots, that may be found.

Schedule Impact Yes ☐ No X

Cost Impact Yes X No ☐

The manpower cost to blend the areas "if" required.

Alstom's Engineering Department Recommendations

No disposition required.

Customer's Response

Written By:		Position:	Date:
Distribution For Action:	Client ☐	Engineering ☐	Project Manager ☐
Distribution For Information:	Client ☐	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR #STM-002
Subject: HP Turbine Rotor Stage 1 – 3 HP Section. Minor Foreign Object Damage (FOD).		Sheet 2/2 ISSUE #
Station: Holyrood GS	Unit # 1	ALSTOM
Component Inspected: Casing ☐ Rotor X HP X IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☐ Gen. Rotor ☐ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number: 940310	Attachments; (1)PICTURES # RECORD SHEETS	Conformity: Yes ☐ No X Design Response Required: Yes ☐ No X Design Accepted: Yes ☐ No X
Contract # / Main Report #		CLIENT
Programme Reference:		Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Quality Plan Reference:		Signature: Date:

Written By:		Position:	Date:
Distribution For Action:	Client ☐	Engineering ☐	Project Manager ☐
Distribution For Information:	Client ☐	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # STM003

Subject: Turbine Oil Deflectors		Sheet 1/2 ISSUE #
Station: Holyrood Generating Station	Unit # 1	ALSTOM Conformity: Yes ☐ No X Design Response Required: Yes ☐ No X Design Accepted: Yes X No ☐
Component Inspected: Casing ☐ Rotor ☐ HP X IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☐ Gen. Rotor ☐ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; 1 RECORD SHEETS	
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐ Signature: Date:
Programme Reference:		
Quality Plan Reference:		

SITE INSPECTION

Report

T2 thru T3 Oil deflectors measured. Clearances are outside of OEM specification for clearances. Deflectors measure same as the new deflectors installed in 2003.

Recommendations

Return oil deflectors to service. Set bottom clearances per design.

Schedule Impact Yes ☐ No X

Cost Impact Yes ☐ No X

Alstom's Engineering Department Recommendations

Engineering response is not required

Customer's Response

Written By:		Position: LTFA	Date:
Distribution For Action:	Client X	Engineering ☐	Project Manager ☐
Distribution For Information:	Client X	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

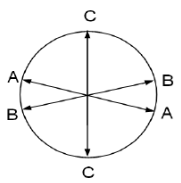
POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # STM003
Subject: Turbine Oil Deflectors		Sheet 2/2 ISSUE #

Station: Holyrood Generating Station	Unit # 1	ALSTOM Conformity: Yes ☐ No X Design Response Required: Yes ☐ No X Design Accepted: Yes X No ☐
Component Inspected: Casing ☐ Rotor ☐ HP X IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☐ Gen. Rotor ☐ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; 1 RECORD SHEETS	
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Programme Reference:		
Quality Plan Reference:		Signature: Date:

Test Certificate

Title: Oil Deflector Clearance

INSPECTIONS & CHECKS				CODE	
Teeth Inspected				X	Work Carried Out
Journals Inspected				N	Not Done
				NA	Not Applicable
				C	See Comments
				V	Visual Inspection
				MP	Mag. Particle
				UT	Ultrasonic
				PT	Penetrant



Location Number	Oil Deflector A-Dia	Oil Deflector B-Dia	Oil Deflector C-Dia	Journal Dia	Clearance Average	Clearance Min.	Clearance Max.	Condition Comment
T1				11.996				
				11.996				
T2 HP	15.020	15.019	15.045	14.999	.033	.020	.046	OK
	15.018	15.019	15.052	14.999	.036	.0195	.053	
T2 LP	15.031	15.025	15.038	14.999	.034	.029	.039	OK
	15.019	15.038	15.032	14.999	.031	.029	.033	
T3 HP	14.029	14.032	14.050	13.999	.041	.031	.051	OK
	14.031	14.026	14.0455	13.999	.038	.029	.046	
T3 LP	14.032	14.033	14.033	13.999	.033	.033	.033	OK
	14.032	14.033	14.037	13.999	.036	.033	.038	

Test Decision (as required/acc. to specification) — Accepted* / Rejected* / NC-Report* / Rework*	Unit / System Name: Holyrood Generating Station Unit 1	
NCR No.*	Part Text: Oil Deflectors	Quantity
Checked by**	Part Idnr / Rev.	Power Station Designation
Approved by**	I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**	Order No.	Factory Order
ALSTOM	Sheet No. 1 / No. of Sh. 2 / Document No. UTGS 623094	Rev. -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Written By:		Position: LTFA	Date:
Distribution For Action:	Client X	Engineering ☐	Project Manager ☐
Distribution For Information:	Client X	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR STM004
Subject: Horizontal Joint Stud Number 40		Sheet 1/1 ISSUE # 1
Station: Holyrood Generating Station	Unit # 1	ALSTOM
Component Inspected: Casing X Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☐ Gen. Rotor ☐ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; # PICTURES # RECORD SHEETS	Conformity: Yes ☐ No X Design Response Required: Yes ☐ No X Design Accepted: Yes X No ☐
Contract # / Main Report #		CLIENT
Programme Reference:		Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Quality Plan Reference:		Signature: Date:

SITE INSPECTION

Report

HP/IP Horizontal Joint Stud number 40, failed UT. Crack indication approx. 8" down from the top of the stud.

Recommendations

Drill out stud, chase the internal thread and install new joint bolt. Note: this is a bottled stud, the upper thread is 4.5"-8 and the lower thread is 5.25"-8 and stud is 20.75" long.

Schedule Impact Yes ☐ No X

Cost Impact Yes X No ☐

Alstom's Engineering Department Recommendations

Customer's Response

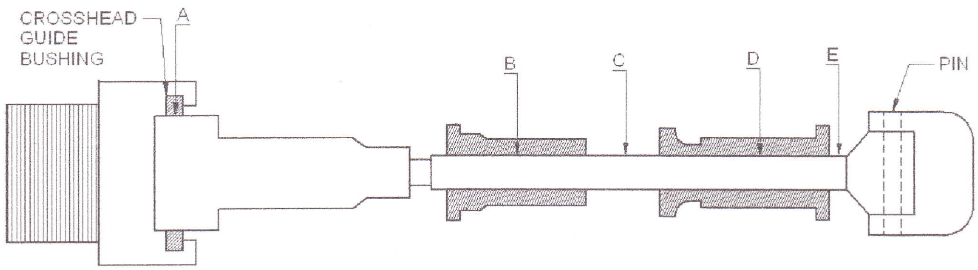
Approved replacement

Written By:	RM Scott	Position: LTFA Turbine	Date: 6/25/12
Distribution For Action:	Client X	Engineering ☐	Project Manager X
Distribution For Information:	Client ☐	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

Test Certificate

Title

GE Shell Mounted Control Valve
Dimensional Inspection



VALVE CLEARANCE																		
VALVE	#1			#2			#3			#4			#5			#6		
	A	B	D	A	B	D	A	B	D	A	B	D	A	B	D	A	B	D
Bushing ID	6.002	1.501	1.502	6.004	1.501	1.502	6.004	1.501	1.502	6.002	1.502	1.501	6.004	1.502	1.502	6.003	1.503	1.500
Stem OD	5.994	1.493	1.493	5.995	1.492	1.492	5.994	1.492	1.493	5.995	1.495	149.3	5.993	1.492	6.492	5.996	1.493	1.492
Clearance	0.008	0.008	0.009	0.009	0.009	0.010	0.010	0.009	0.009	0.007	0.009	0.008	0.011	0.010	0.010	0.007	0.010	0.008

TRY BAR DIAMETER = ______________________

VALVE STEM RUNOUT									
VALVE	Location On Stem					Stem Length	Maximum Runout	Tolerance Check	Stem to Crosshead Torque
	A	B	C	D	E				
#1	0.003	Ø	0.002		Ø		0.003		300
#2	0.003	Ø	Ø		Ø		0.003		450
#3	0.005	0.001	Ø		Ø		0.005		300
#4	0.006	Ø	0.003		Ø		0.006		300
#5	0.004	Ø	Ø		Ø		0.004		450
#6	0.005	Ø	0.005		Ø		0.005		300

Allowable TIR .002"/FT. # 2 + 5 NEW STEMS

VALVE	#1	#2	#3	#4	#5	#6
DISK PIN FIT ID						
PIN OD						
CLEARANCE						

Measurment Units

☒ Inches ☐ Millimeters

Measurement Condition

☐ As-found ☒ As-left

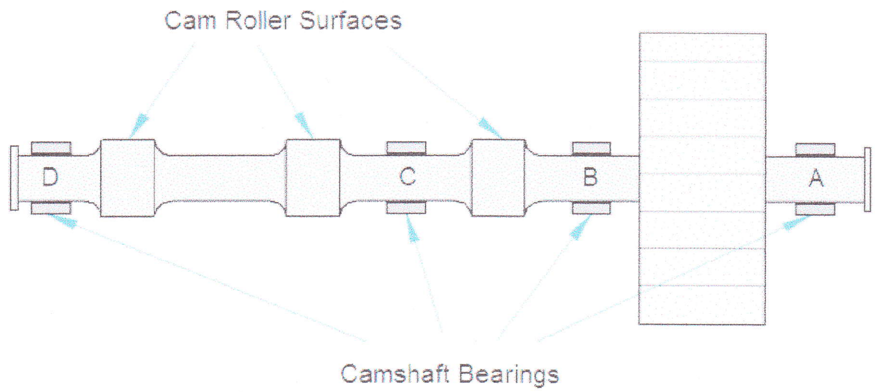
Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: OOEM – GE Standard	
	NC-Report*		Rework*			
NCR No.*					Part Text: GE Shell Mounted Control Valve	Quantity
Checked by**					Part Idnr / Rev.	Power Station Designation
Approved by**					I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.	Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 1 / Document No. UTGS622595	Rev. -

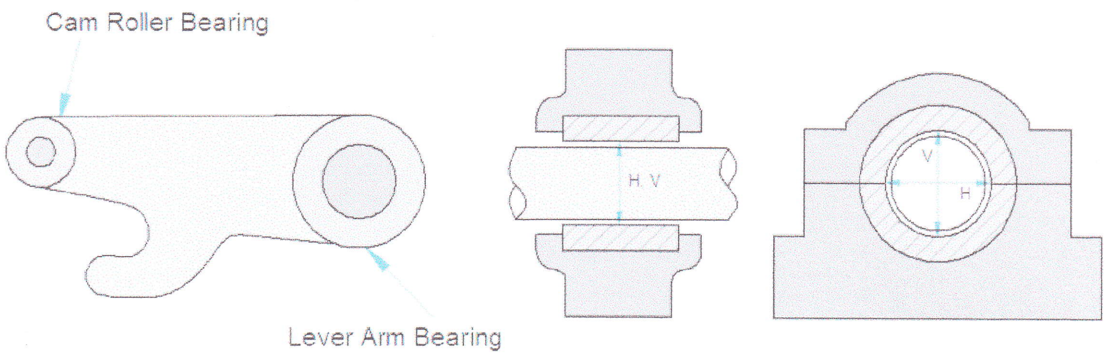
* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title

GE Shell Mounted Control Valve
Lever Arm & Camshaft Calculated Clearances





Cam Roller: ROLLERS WERE INSPECTED CLEARANCES CONFIRMED TO BE MINIMAL

Valve No.	#1		#2		#3		#4		#5		#6	
	H	V	H	V	H	V	H	V	H	V	H	V
Bearing ID												
Pin OD												
Clearance												

Measurment Units

☒ Inches ☐ Millimeters

Measurement Condition

☐ As-found ☒ As-left

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: OOEM – GE Standard
	NC-Report*		Rework*		
NCR No.*					Part Text: Shell Mounted Control Valve; Quantity:
Checked by**					Part Idnr: ; Rev.: ; Power Station Designation:
Approved by**					I & T Plan ID: ; Rev.: ; Test Step: ; Material Test No.:
Authority / Customer**					Order No.: ; Factory Order:
ALSTOM					Sheet No.: 1; No. of Sh.: 2; Document No.: UTGS622596; Rev.: -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title

GE Shell Mounted Control Valve
Lever Arm & Camshaft Calculated Clearances

Lever Arm: ALL NEW DU BEARINGS INSTALLED

Valve No.	#1		#2		#3		#4		#5		#6	
	H	V	H	V	H	V	H	V	H	V	H	V
Bearing ID	3.002	3.002	3.002	3.002	3.002	3.002	3.002	3.002	3.002	3.002	3.002	3.002
Pin OD	2.999	2.999	2.999	2.999	2.999	2.999	2.999	2.999	2.999	2.999	2.999	2.999
Clearance	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003

Upper Half Cam Shaft:

Valve No.	A		B		C		D	
	H	V	H	V	H	V	H	V
Bearing ID	3.003	3.003	3.001	3.001	3.001	3.003	3.002	3.002
Shaft OD	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Clearance	0.003	0.003	0.001	0.001	0.001	0.003	0.002	0.002

Lower Half Cam Shaft:

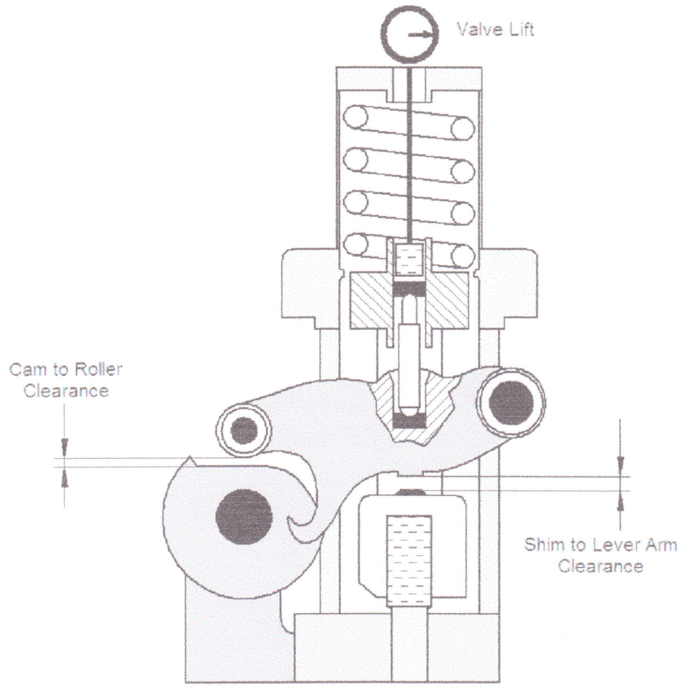
Valve No.	A		B		C		D	
	H	V	H	V	H	V	H	V
Bearing ID	3.003	3.006	3.002	3.002	3.002	3.004	3.002	3.005
Shaft OD	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Clearance	0.003	0.006	0.002	0.002	0.002	0.004	0.002	0.005

Unit / System Name	Order No.			Factory Order	
ALSTOM	Sheet No. 2	No. of Sh. 2	Document No.	UTGS622596	Rev. -

Test Certificate

Title

GE Shell Mounted Control Valve
Stroke Measurement & Adjustments



Valve No.	#1	#2	#3	#4	#5	#6
Cam to Roller Clearance	0.072	Ø	Ø	0.121	0.017	0.142
Shim to Lever Arm Clearance	0.096	0.040	0.035	0.073	0.070	0.085
Control Valve Lift	1.457	1.575		1.299	1.299	1.534

Measurment Units

☒ Inches ☐ Millimeters

Measurement Condition

☐ As-found ☒ As-left

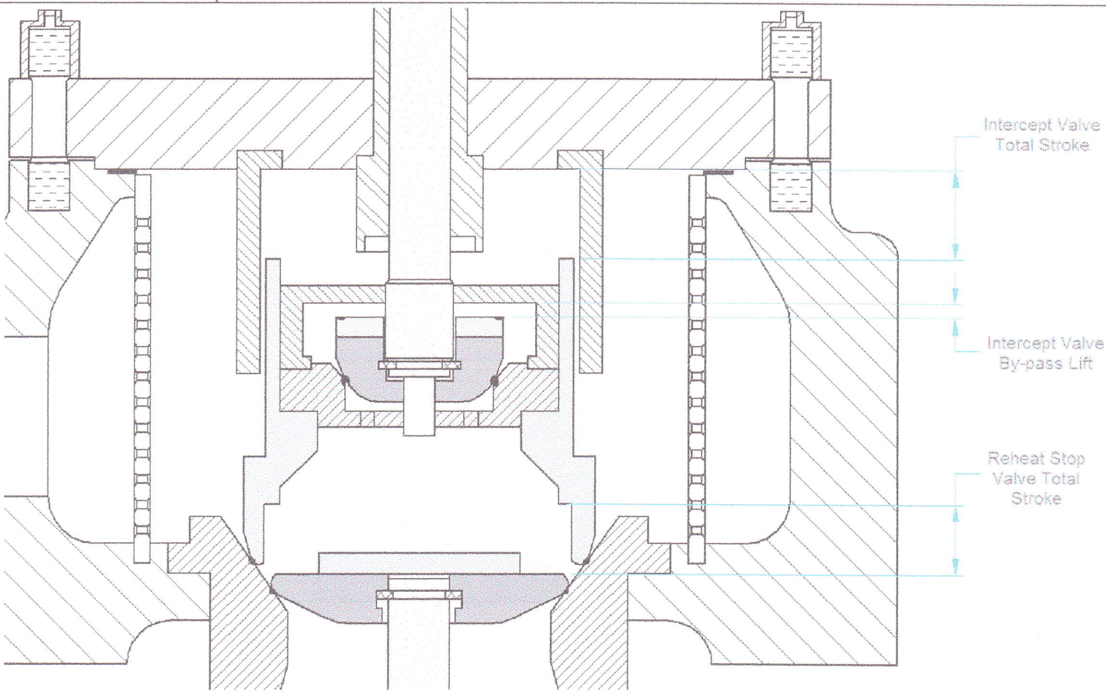
Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: OOEM – GE Standard	
	NC-Report*		Rework*			
NCR No.*					Part Text: Shell Mounted Control Valve	Quantity
Checked by**					Part Idnr / Rev.	Power Station Designation
Approved by**					I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.	Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 2 / Document No. UTGS622597	Rev. -

* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title

GE Combined Reheat Stop and Intercept Valve Stroke Measurement



Reheat Valve No.	Total Intercept Valve Stroke	Intercept By-pass Valve Lift	Total Stop Valve Stroke
LEFT	6.063	0.500	5.950
RIGHT	6.125	0.500	6.024

Measurment Units: [X] Inches [ ] Millimeters

Measurement Condition: [ ] As-found [X] As-left

Test Decision (as required/acc. to specification)	Accepted*		Rejected*	
	NC-Report*		Rework*	

Unit / System Name: OOEM – GE Standard

NCR No.*:

Part Text: Combined Reheat Stop & Intercept Valve

Quantity:

Checked by**:

Part Idnr: Rev.:

Power Station Designation:

Approved by**:

I & T Plan ID: Rev.:

Test Step: Material Test No.:

Authority / Customer**:

Order No.:

Factory Order:

ALSTOM

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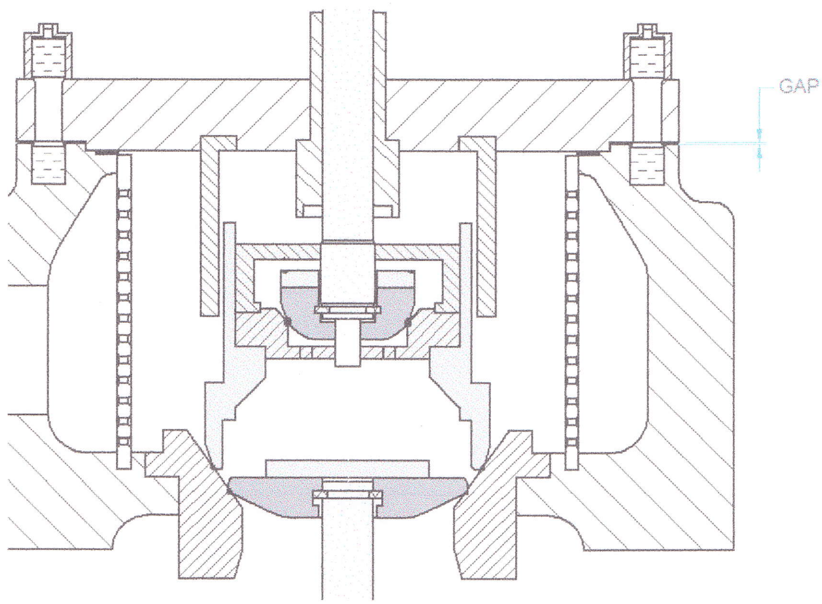
1	1	UTGS622604	-

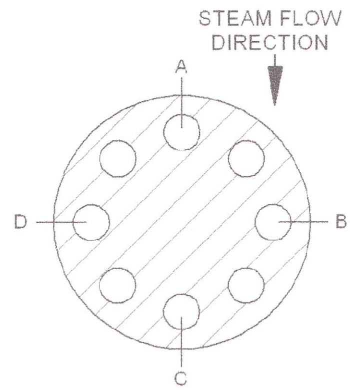
* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title

GE Combined Reheat Stop and Intercept Valve Cover to Body Measurement





Reheat Valve No.	Meas. Location	Measured Gap
LEFT	A	0.038
	B	0.028/0.030
	C	0.038
	D	0.036
RIGHT	A	0.038
	B	0.037
	C	0.044
	D	0.040/0.036

Measurment Units

☒ Inches ☐ Millimeters

Measurement Condition

☐ As-found ☒ As-left

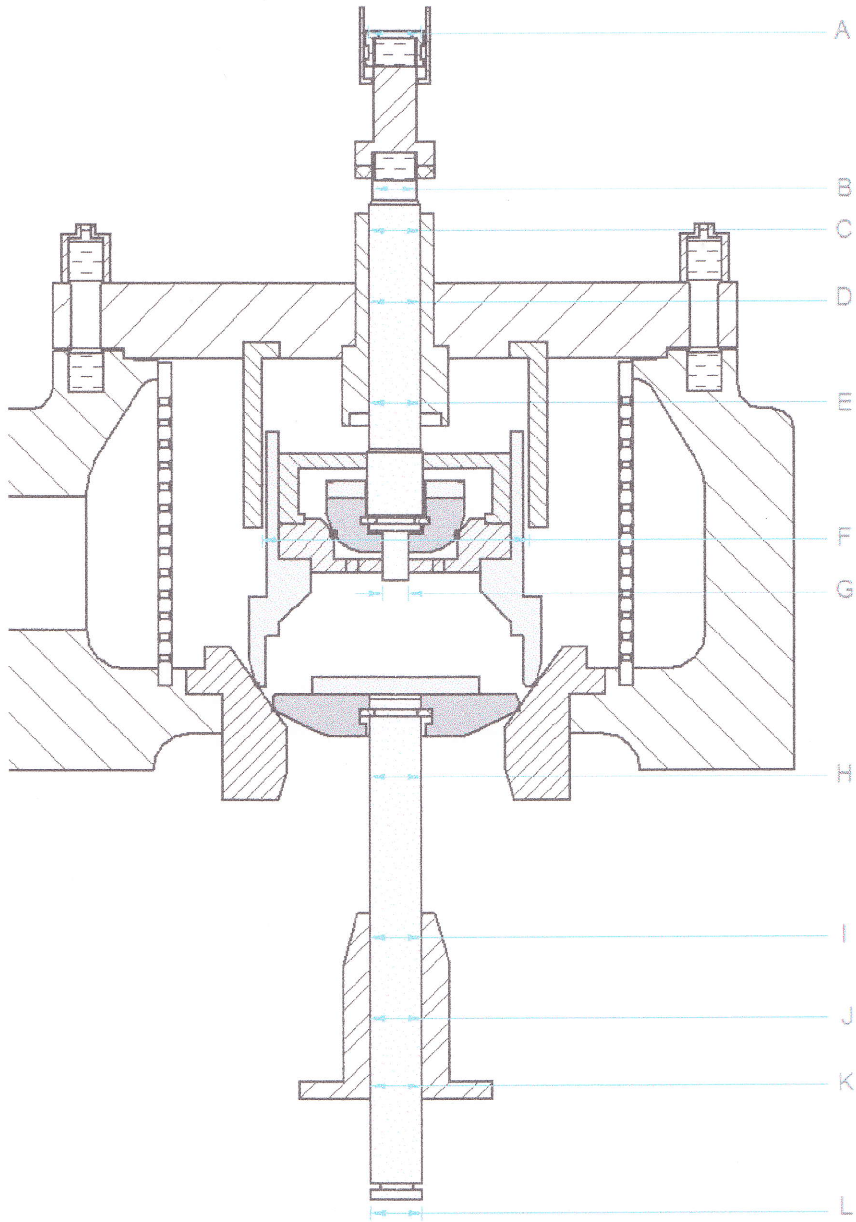
Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: OOEM – GE Standard
	NC-Report*		Rework*		

NCR No.*	Part Text: Combined Reheat Stop & Intercept Valve		Quantity
Checked by**	Part Idnr	Rev.	Power Station Designation
Approved by**	I & T Plan ID	Rev.	Test Step / Material Test No.
Authority / Customer**	Order No.		Factory Order

ALSTOM	Sheet No.	No. of Sh.	Document No.	Rev.
	1	1	UTGS622605	-

* Mark/Fill in if applicable ** Name / dept / date / initials

Test Certificate	Title GE Combined Reheat Stop and Intercept Valve Dimensional Inspection



Test Decision (as required/acc. to specification)	Accepted* / NC-Report*	Rejected* / Rework*	Unit / System Name: OOEM – GE Standard			
NCR No.*			Part Text: Combined Reheat Stop & Intercept Valve			Quantity
Checked by**			Part Idnr	Rev.	Power Station Designation	
Approved by**			I & T Plan ID	Rev.	Test Step	Material Test No.
Authority / Customer**			Order No.		Factory Order	
ALSTOM			Sheet No. 1	No. of Sh. 2	Document No. UTGS622603	Rev. -

* Mark/Fill in if applicable   ** Name / dept. / date / initials

Test Certificate

Title

GE Combined Reheat Stop and Intercept Valve Dimensional Inspection

Valve ID LEFT

Meas. Location	Description	Measurement
A	Crosshead Guide Bushing ID	7.126
	Crosshead OD	7.103
	Clearance	0.023
C	Bushing ID	2.376
	Stem OD	2.362
	Clearance	0.014
E	Bushing ID	2.378
	Stem OD	2.359
	Clearance	0.019
F	Valve Guide ID	16.113
	Seal Ring OD	16.101
	Clearance	0.012
I	Bushing ID	2.562
	Stem OD	2.487
	Clearance	0.075
K	Bushing ID	2.998
	Stem OD	2.985
	Clearance	0.013

Intercept Valve Trybar Diameter 2.369

Reheat Stop Valve Trybar Diameter 2.999

Stem Runout	Location on Stem			Stem Length	Max Runout	Tolerance Check
Intercept Valve	B	D	G			
	0.001	Ø	0.013			
Reheat Stop Valve	H	J	L			
	0.003	0.0015	Ø			

*Allowable TIR is 0.002"/ft

Measurment Units

☒ Inches ☐ Millimeters

Measurement Condition

☐ As-found ☒ As-left

Unit / System Name	Order No.	Factory Order

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Test Certificate

Title

GE Combined Reheat Stop and Intercept Valve Dimensional Inspection

Valve ID RIGHT

Meas. Location	Description	Measurement
A	Crosshead Guide Bushing ID	7.126
	Crosshead OD	7.102
	Clearance	0.024
C	Bushing ID	2.373
	Stem OD	2.363
	Clearance	0.010
E	Bushing ID	2.376
	Stem OD	2.364
	Clearance	0.012
F	Valve Guide ID	16.103
	Seal Ring OD	16.093
	Clearance	0.010
I	Bushing ID	2.556
	Stem OD	2.488
	Clearance	0.068
K	Bushing ID	2.996
	Stem OD	2.988
	Clearance	0.008

Intercept Valve Trybar Diameter 2.369

Reheat Stop Valve Trybar Diameter 2.999

Stem Runout	Location on Stem			Stem Length	Max Runout	Tolerance Check
Intercept Valve	B	D	G			
	0.001	0.002	0.003			
Reheat Stop Valve	H	J	L			
	0.001	0.001	0			

*Allowable TIR is 0.002"/ft

Measurment Units

☒ Inches ☐ Millimeters

Measurement Condition

☐ As-found ☒ As-left

Unit / System Name	Order No.	Factory Order

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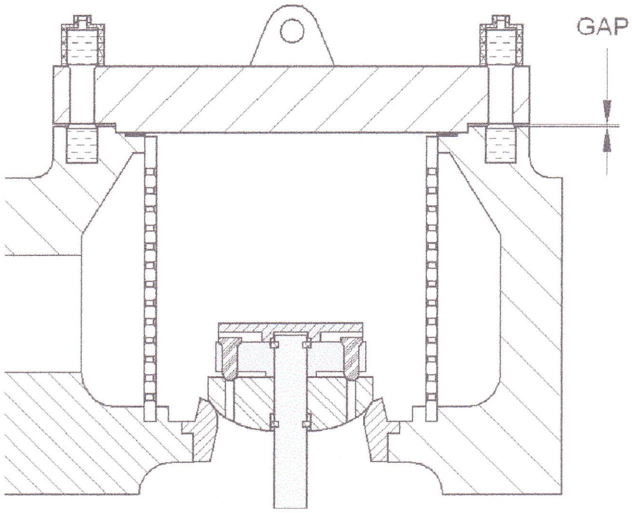
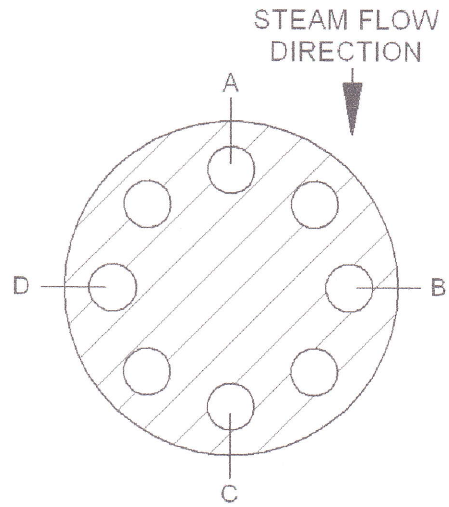
Test Certificate

Title

GE Main Stop Valve
Cover to Body Measurement





Main Stop Valve No.	Meas. Location	Measured Gap
	A	0.002
	B	0.001
	C	0.002
	D	0.003
	A	
	B	
	C	
	D	

Measurment Units	Measurement Condition
[X] Inches [ ] Millimeters	[ ] As-found [X] As-left

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: OOEM – GE Standard
	NC-Report*		Rework*		

NCR No.*	Part Text: Main Stop Valve		Quantity
Checked by**	Part Idnr	Rev.	Power Station Designation
Approved by**	I & T Plan ID	Rev.	Test Step / Material Test No.
Authority / Customer**	Order No.		Factory Order

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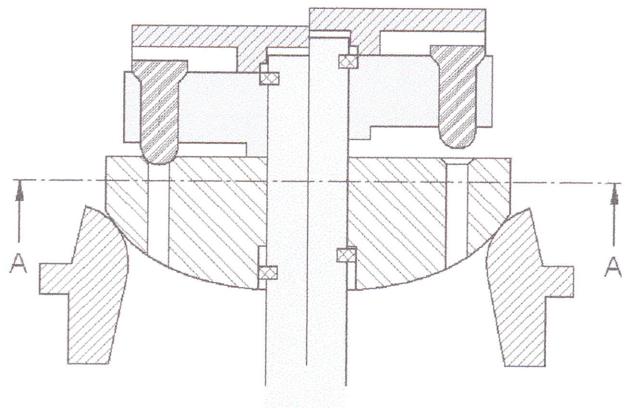
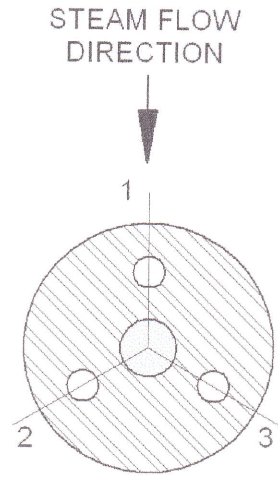
* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title

GE Main Stop Valve (w/ 3 Pilots)
Stroke Measurement





SECTION A-A

Main Stop Valve No.	Total Valve Stroke	By-pass Location No.	By-pass Valve Lift
	6.188	1	
		2	1.083
		3	
		1	
		2	
		3	

Measurment Units: ☒ Inches ☐ Millimeters

Measurement Condition: ☐ As-found ☒ As-left

Test Decision (as required/acc. to specification)	Accepted*		Rejected*	
	NC-Report*		Rework*	

NCR No.*	
Checked by**	
Approved by**	
Authority / Customer**	

Unit / System Name	OOEM – GE Standard
Part Text	Main Stop Valve (w/ 3 Pilots)
Quantity	
Part Idnr	
Rev.	
Power Station Designation	
I & T Plan ID	
Rev.	
Test Step	
Material Test No.	
Order No.	
Factory Order	

ALSTOM

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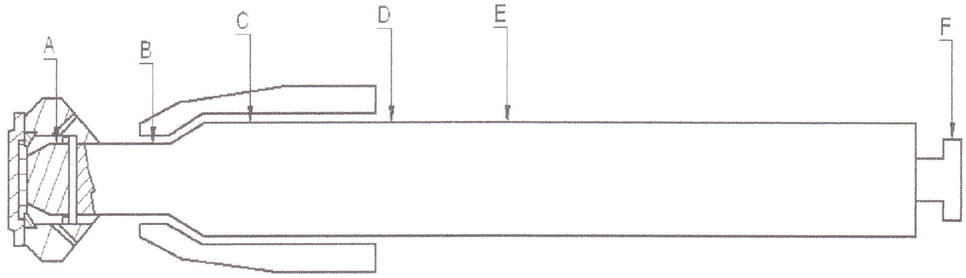
* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title

GE Main Stop Valve
Dimensional Inspection



VALVE CLEARANCE		A	B	C	D
VALVE NO.	Bushing ID	2.763	2.82	3.500	3.500
	Stem OD	2.752	2.752	3.486	3.486
TRY BAR DIA.	Clearance	0.011	0.068	0.014	0.014
VALVE NO.	Bushing ID				
	Stem OD				
TRY BAR DIA.	Clearance				

NEW STEM
NEW BUSHING

VALVE NO.	STEM LENGTH	MAX ALLOWABLE TIR	A	B	C	D	E	F	MAX RUNOUT	TOLERANCE CHECK
	60.236		Ø	Ø	Ø	Ø	Ø	Ø		

Allowable TIR .002"/FT.

Measurment Units	Measurement Condition
☒ Inches ☐ Millimeters	☐ As-found ☒ As-left

Test Decision (as required/acc. to specification)	Accepted* / NC-Report* / Rejected* / Rework*	Unit / System Name: OOEM – GE Standard	
NCR No.*		Part Text: GE Main Stop Valve	Quantity
Checked by**		Part Idnr / Rev.	Power Station Designation
Approved by**		I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**		Order No.	Factory Order
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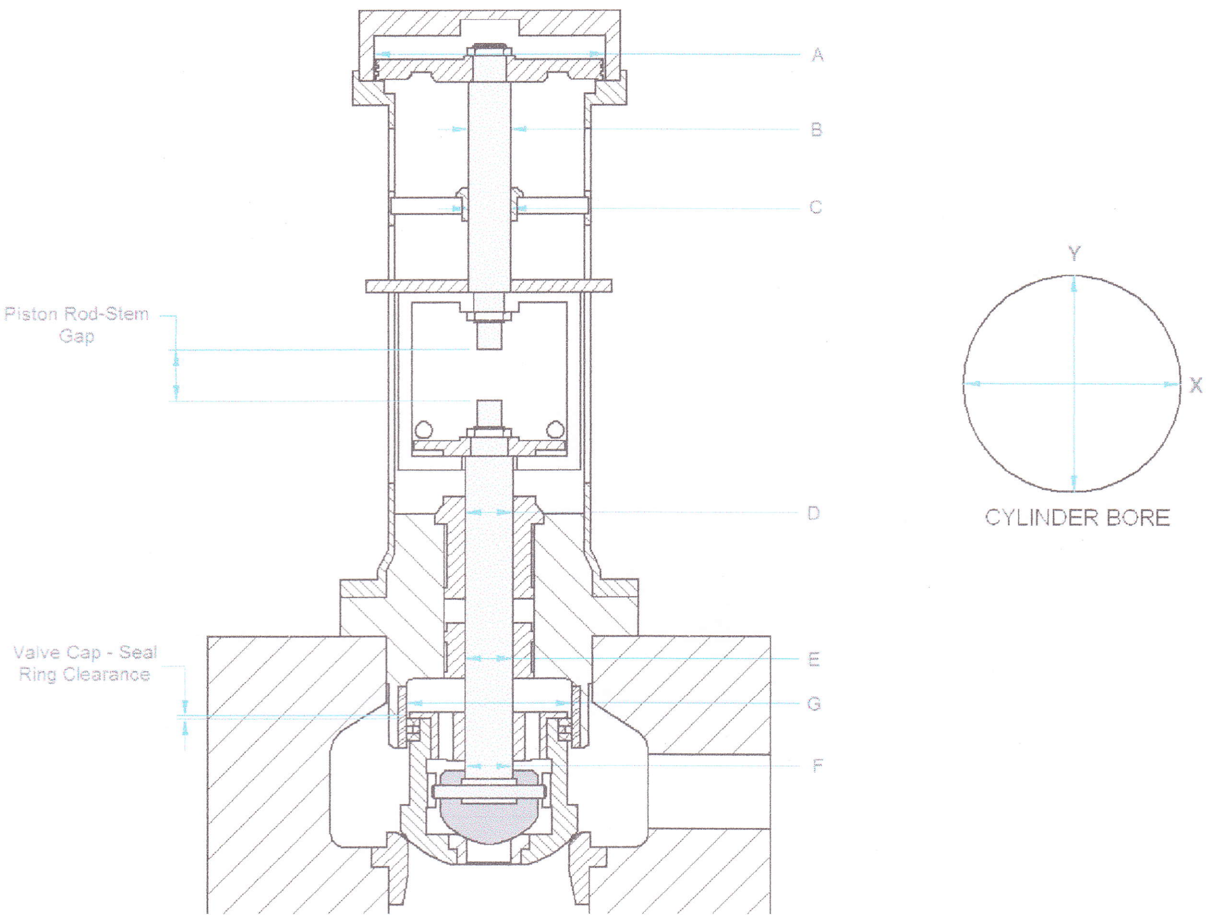
* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title

GE Blowdown Valve Dimensional Inspection



Test Decision (as required/acc. to specification)	Accepted*	Rejected*	Unit / System Name: OOEM – GE Standard	
	NC-Report*	Rework*		
NCR No.*			Part Text: Blowdown Valve	Quantity
Checked by**			Part Idnr / Rev.	Power Station Designation
Approved by**			I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**			Order No.	Factory Order
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* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title

GE Blowdown Valve
Dimensional Inspection

Valve ID ________

Meas. Location	Description	Measurement X	Measurement Y
A	Cylinder ID	8.525	8.533
	Upper Piston Ring OD	8.464	8.464
	Clearance	0.061	0.069
G	Bushing ID	4.998	4.995
	Lower Piston Ring OD	4.993	4.989
	Clearance	0.005	0.006
C	Bushing ID	1.125	
	Piston Rod OD	1.120	
	Clearance	0.005	
D	Bushing ID	1.126	
	Stem OD	1.120	
	Clearance	0.006	
E	Bushing ID	1.125	
	Stem OD	1.119	
	Clearance	0.006	

Piston Rod – Stem Gap________________ 0.274

Valve Cap – Seal Ring Clearance__________ 0.001

Valve Stem Runout							
Location on Stem					Stem Length	Max Runout	Tolerance Check
B	C	D	E	F			
0.0002	0.0002	0.0008	0.0003	0.0002	15.0	0.0006	

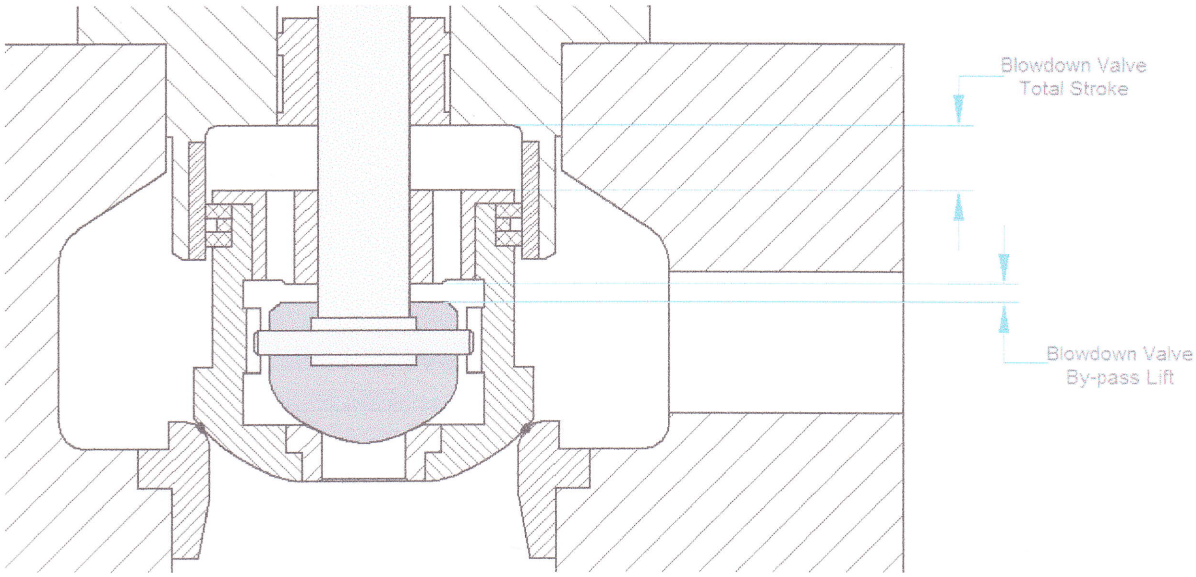
*Allowable TIR is 0.002"/ft

Measurment Units: ☒ Inches ☐ Millimeters		Measurement Condition: ☐ As-found ☒ As-left		
Unit / System Name	Order No.		Factory Order	
ALSTOM	Sheet No. 2	No. of Sh. 2	Document No. UTGS622600	Rev. -

Test Certificate

Title

GE Blowdown Valve Stroke Measurement



Blowdown Valve ID	Total Valve Stroke	By-pass Valve Lift
	1.250	0.313

Measurment Units

☒ Inches ☐ Millimeters

Measurement Condition

☐ As-found ☒ As-left

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: OOEM – GE Standard		
	NC-Report*		Rework*				
NCR No.*					Part Text: Blowdown Valve		Quantity
Checked by**					Part Idnr	Rev.	Power Station Designation
Approved by**					I & T Plan ID	Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.		Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 1	Document No. UTGS622601	Rev. -

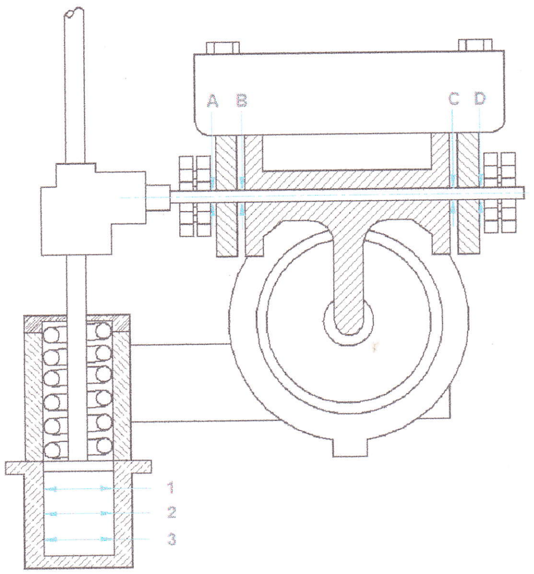
* Mark/Fill in if applicable ** Name / dept. / date / initials

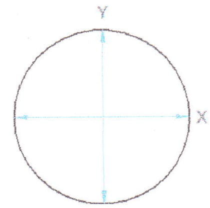
Test Certificate

Title

GE Non-Return Valve & Actuator Dimensional Inspection

Valve ID 101





CYLINDER BORE

Valve Meas. Location	A	B	C	D
Bushing Bore ID	1.140	1.153	1.155	1.134
Valve Shaft OD	1.125	1.125	1.125	1.125
Piston Rod Clearance	0.015	0.028	0.030	0.009

Actuator Meas. Location	#1		#2		#3	
	X	Y	X	Y	X	Y
Cylinder ID	5.0	5.0	5.0	5.0	5.0	5.0
Piston OD	4.993	4.994			4.995	4.995
Clearance	0.007	0.006			0.005	0.005

Measurment Units

☐ Inches ☐ Millimeters

Measurement Condition

☐ As-found ☐ As-left

Test Decision (as required/acc. to specification)	Accepted*		Rejected*	
	NC-Report*		Rework*	

Unit / System Name: OOEM – GE Standard

NCR No.*

Part Text: Non-Return Valve & Actuator

Quantity

Checked by**

Part Idnr

Rev.

Power Station Designation

Approved by**

I & T Plan ID

Rev.

Test Step

Material Test No.

Authority / Customer**

Order No.

Factory Order

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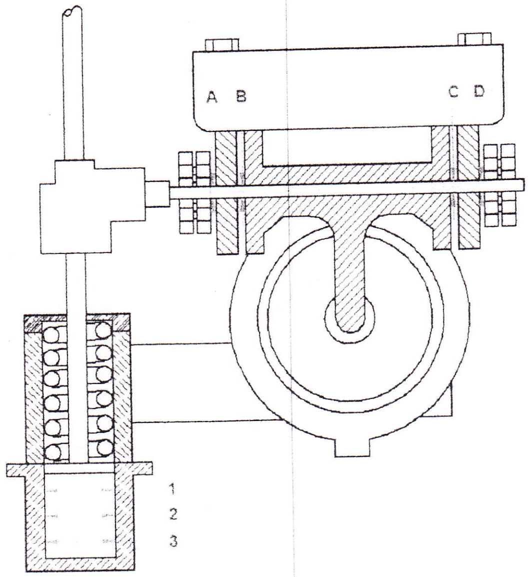
* Mark/Fill in if applicable ** Name / dept. / date / initials

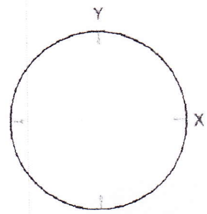
Test Certificate

Title

GE Non-Return Valve & Actuator
Dimensional Inspection

Valve ID 102





Valve Meas. Location	A	B	C	D
Bushing Bore ID	1.139	1.167	1.170	1.133
Valve Shaft OD	1.125	1.125	1.125	1.125
Piston Rod Clearance	0.014	0.042	0.045	0.008

Actuator Meas. Location	#1		#2		#3	
	X	Y	X	Y	X	Y
Cylinder ID	5.002	5.002	5.002	5.001	5.0	5.001
Piston OD	4.992	4.993			4.99	4.992
Clearance	0.010	0.009			0.010	0.009

Measurment Units

☒ Inches ☐ Millimeters

Measurement Condition

☐ As-found ☒ As-left

Test Decision (as required/acc. to specification)	Accepted*	☐	Rejected*	☐
	NC-Report*	☐	Rework*	☐

Unit / System Name: OOEM – GE Standard

NCR No.*

Part Text: Non-Return Valve & Actuator

Quantity

Checked by**

Part Idnr | Rev. | Power Station Designation

Approved by**

I & T Plan ID | Rev. | Test Step | Material Test No.

Authority / Customer**

Order No. | Factory Order

ALSTOM

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1	1	UTGS622602	-

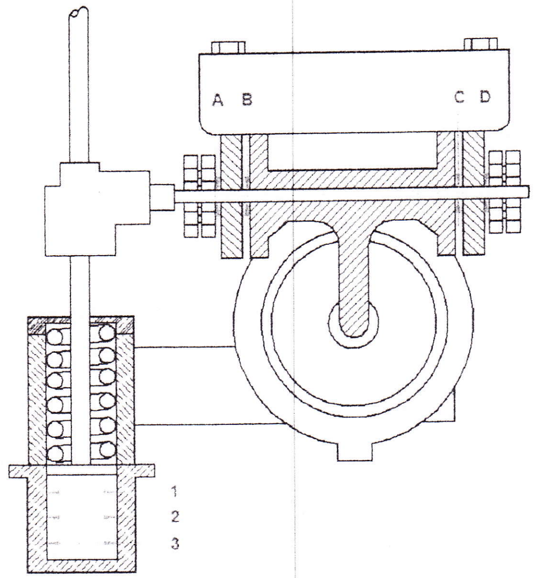
* Mark/Fill in if applicable ** Name / dept. / date / initials

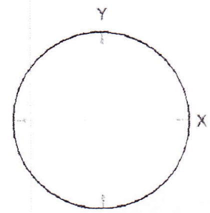
Test Certificate

Title

GE Non-Return Valve & Actuator Dimensional Inspection

Valve ID 103





Valve Meas. Location	A	B	C	D
Bushing Bore ID	1.135	1.156	1.157	1.135
Valve Shaft OD	1.125	1.125	1.125	1.125
Piston Rod Clearance	0.010	0.031	0.032	0.010

Actuator Meas. Location	#1		#2		#3	
	X	Y	X	Y	X	Y
Cylinder ID	5.0	4.999	5.0	5.0	5.0	5.002
Piston OD	4.99	4.889			4.99	4.991
Clearance	0.010	0.010			0.10	0.011

Measurment Units		Measurement Condition	
☒ Inches	☐ Millimeters	☐ As-found	☒ As-left

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: OOEM – GE Standard	
	NC-Report*		Rework*			
NCR No.*					Part Text: Non-Return Valve & Actuator	Quantity
Checked by**					Part Idnr / Rev.	Power Station Designation
Approved by**					I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.	Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 1	Document No. UTGS622602 / Rev. -

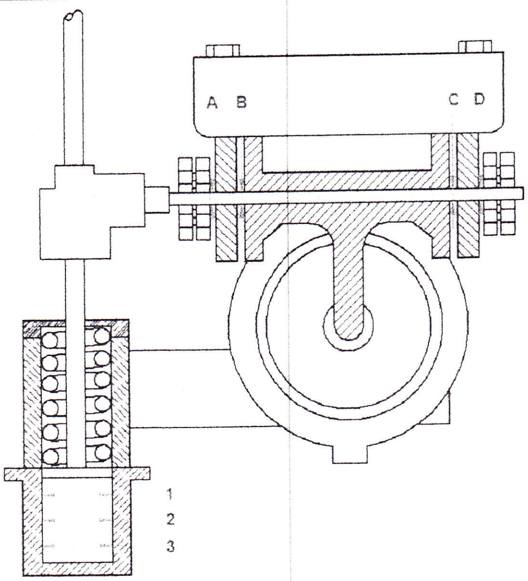
* Mark/Fill in if applicable ** Name / dept. / date / initials

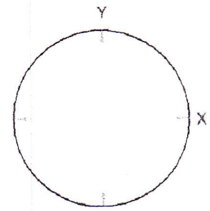
Test Certificate

Title

GE Non-Return Valve & Actuator Dimensional Inspection

Valve ID 104 A





Valve Meas. Location	A	B	C	D
Bushing Bore ID	1.140	1.152	1.154	1.137
Valve Shaft OD	1.125	1.125	1.125	1.125
Piston Rod Clearance	0.015	0.017	0.019	0.012

Actuator Meas. Location	#1		#2		#3	
	X	Y	X	Y	X	Y
Cylinder ID	5.002	5.003	5.003	5.004	5.003	5.003
Piston OD	4.995	4.995			4.995	4.996
Clearance	0.007	0.008			0.008	0.007

Measurment Units: ☒ Inches ☐ Millimeters

Measurement Condition: ☐ As-found ☒ As-left

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: OOEM – GE Standard
	NC-Report*		Rework*		

NCR No.*	Part Text: Non-Return Valve & Actuator		Quantity
Checked by**	Part Idnr	Rev.	Power Station Designation
Approved by**	I & T Plan ID	Rev.	Test Step / Material Test No.
Authority / Customer**	Order No.		Factory Order
ALSTOM	Sheet No. 1 / No. of Sh. 1	Document No. UTGS622602	Rev. -

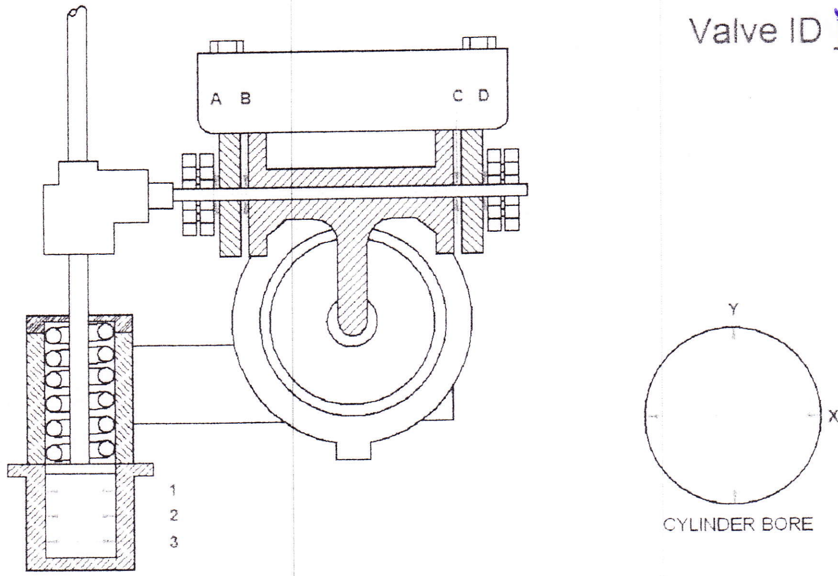
* Mark/Fill in if applicable ** Name / dept / date / initials

Test Certificate

Title

GE Non-Return Valve & Actuator
Dimensional Inspection

Valve ID 104 B



Valve Meas. Location	A	B	C	D
Bushing Bore ID	1.137	1.157	1.152	1.148
Valve Shaft OD	1.125	1.125	1.125	1.125
Piston Rod Clearance	0.012	0.032	0.027	0.023

Actuator Meas. Location	#1		#2		#3	
	X	Y	X	Y	X	Y
Cylinder ID	5.002	5.001	5.002	5.0	5.0	5.0
Piston OD	4.997	4.996			4.997	4.997
Clearance	0.005	0.005			0.003	0.003

Measurment Units

☒ Inches ☐ Millimeters

Measurement Condition

☐ As-found ☒ As-left

Test Decision (as required/acc. to specification)	Accepted*		Rejected*		Unit / System Name: OOEM – GE Standard	
	NC-Report*		Rework*			
NCR No.*					Part Text: Non-Return Valve & Actuator	Quantity
Checked by**					Part Idnr / Rev.	Power Station Designation
Approved by**					I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**					Order No.	Factory Order
ALSTOM					Sheet No. 1 / No. of Sh. 1	Document No. UTGS622602 / Rev. -

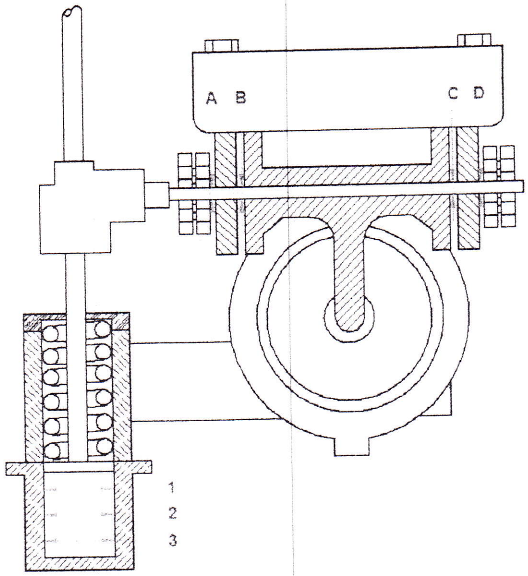
* Mark/Fill in if applicable ** Name / dept. / date / initials

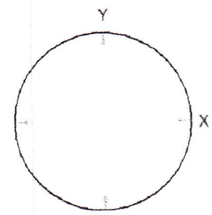
Test Certificate

Title

GE Non-Return Valve & Actuator
Dimensional Inspection

Valve ID 106





CYLINDER BORE

Valve Meas. Location	A	B	C	D
Bushing Bore ID	1.637	1.642	1.640	1.638
Valve Shaft OD	1.623	1.625	1.625	1.623
Piston Rod Clearance	0.014	0.027	0.015	0.015

Actuator Meas. Location	#1		#2		#3	
	X	Y	X	Y	X	Y
Cylinder ID	6.50	6.502	6.502	6.502	6.50	6.50
Piston OD	6.493	6.493			6.494	6.494
Clearance	0.007	0.009			0.006	0.007

Measurment Units		Measurement Condition	
☒ Inches	☐ Millimeters	☐ As-found	☒ As-left

Test Decision (as required/acc. to specification)	Accepted* / NC-Report*	Rejected* / Rework*	Unit / System Name: OOEM – GE Standard	
NCR No.*			Part Text: Non-Return Valve & Actuator	Quantity
Checked by**			Part Idnr / Rev.	Power Station Designation
Approved by**			I & T Plan ID / Rev.	Test Step / Material Test No.
Authority / Customer**			Order No.	Factory Order
ALSTOM			Sheet No. 1 / No. of Sh. 1	Document No. UTGS622602 / Rev. -

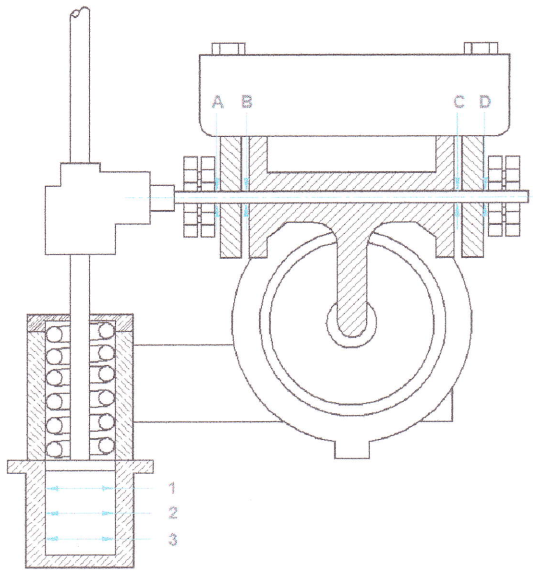
* Mark/Fill in if applicable ** Name / dept / date / initials

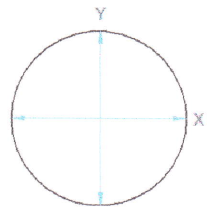
Test Certificate

Title

GE Non-Return Valve & Actuator
Dimensional Inspection

Valve ID 109





CYLINDER BORE

Valve Meas. Location	A	B	C	D
Bushing Bore ID	1.638	1.638	1.631	1.638
Valve Shaft OD	1.623	1.625	1.625	1.623
Piston Rod Clearance	0.015	0.013	0.006	0.015

Actuator Meas. Location	#1		#2		#3	
	X	Y	X	Y	X	Y
Cylinder ID	6.502	6.502	6.502	6.502	6.498	6.50
Piston OD	6.490	6.491			6.493	6.494
Clearance	0.012	0.011			0.005	0.006

Measurment Units

☒ Inches ☐ Millimeters

Measurement Condition

☐ As-found ☒ As-left

Test Decision (as required/acc. to specification) | Accepted* | Rejected* | NC-Report* | Rework*

Unit / System Name: OOEM – GE Standard

NCR No.*

Part Text: Non-Return Valve & Actuator

Quantity

Checked by**

Part Idnr | Rev. | Power Station Designation

Approved by**

I & T Plan ID | Rev. | Test Step | Material Test No.

Authority / Customer**

Order No. | Factory Order

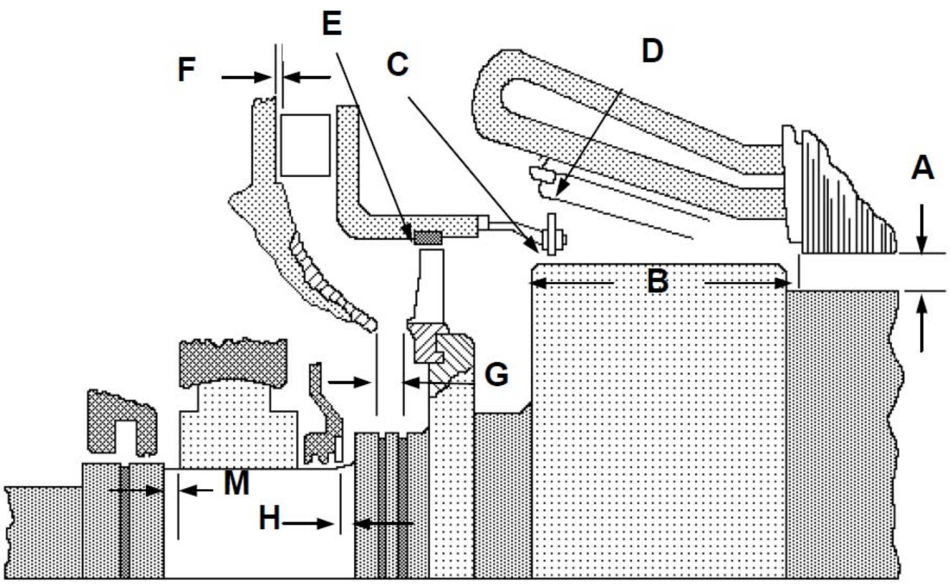
ALSTOM

Sheet No. 1 | No. of Sh. 1 | Document No. UTGS622602 | Rev. -

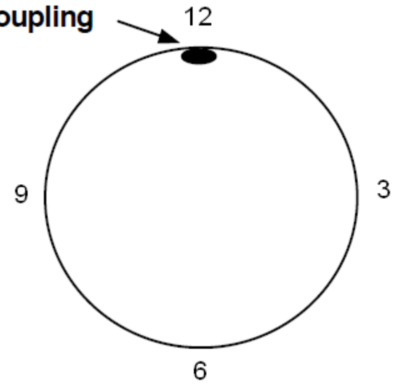
* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title: **Standard GE Generator Rotor Clearances - DE**



Assembly mark on T-G coupling



Clearances	12:00	3:00	6:00	9:00
A				
B				
C				
D				
E	.096	.082	.095	.070
F				
G				
H				
M				

Comments:

Test Decision: (as required/acc.to specification)	**Accepted*** ☐ **NC-Report*** ☐	**Rejected*** ☐ **Rework*** ☐	Plant / unit: **Holyrood Unit 1**
Shop* ☐ Site* ☐	before overhaul* ☐ after overhaul* ☐	NCR No.*	Product designation: Generator "As Found" / Quantity:
Checked By**: Bill Cochran 5-31-2012			Ident No.: / Rev.: / Power station designation:
Approved By**: James George 5-31-2012			I & T plan No.: UTGE622040 / Rev.: A / Test step: 3.0020 / Mat. test. No.:
Authority / Customer**:			Order No.: / Factory Order:

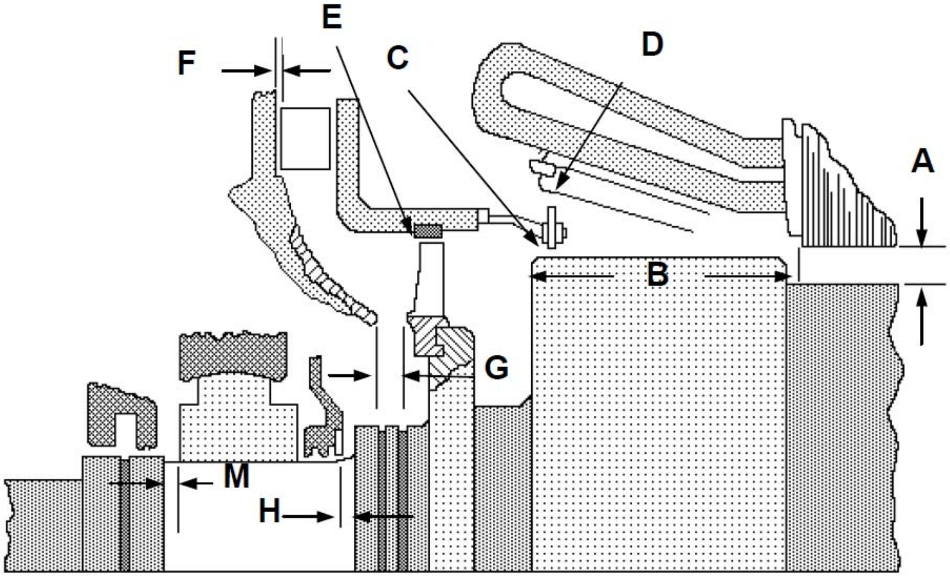
Resp. dept.	Prepared**	Checked**	Released**	Doc.-Type	Language
Generator Eng	C Fortier 21-May-2012	J Jensen 21-May-2012	J Fiaux 21-May-2012	TC	EN

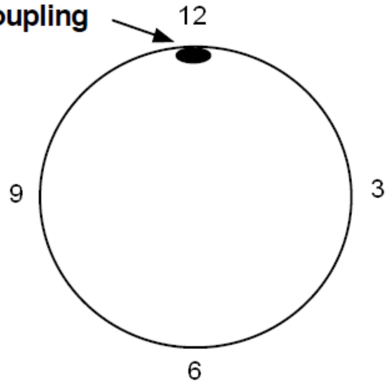
	Document No.	Rev.	Sheet No.	No.of sh.
ALSTOM	UTGE 622037	-	1	1

* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title: **Standard GE Generator Rotor Clearances - DE**





Clearances	12:00	3:00	6:00	9:00
A				
B				
C				
D				
E	.097	.067	.097	.043
F				
G				
H				
M				

Comments:

Test Decision: (as required/acc.to specification)
Accepted* ☐ **Rejected*** ☐
NC-Report* ☐ **Rework*** ☐

Shop* ☐ before overhaul* ☐
Site* ☐ after overhaul* ☐
NCR No.*

Checked By**
Joe Pitcher 7-3-2012

Approved By**
James George 7-3-2012

Authority / Customer**

Plant / unit
Holyrood Unit 1

Product designation
Generator "As Left"

Quantity

Ident No.

Rev.

Power station designation

I & T plan No.
UTGE622040

Rev.
A

Test step
9.0020

Mat. test. No.

Order No.

Factory Order

Resp. dept.	Prepared**	Checked**	Released**	Doc.-Type	Language
Generator Eng	C Fortier 21-May-2012	J Jensen 21-May-2012	J Fiaux 21-May-2012	TC	EN

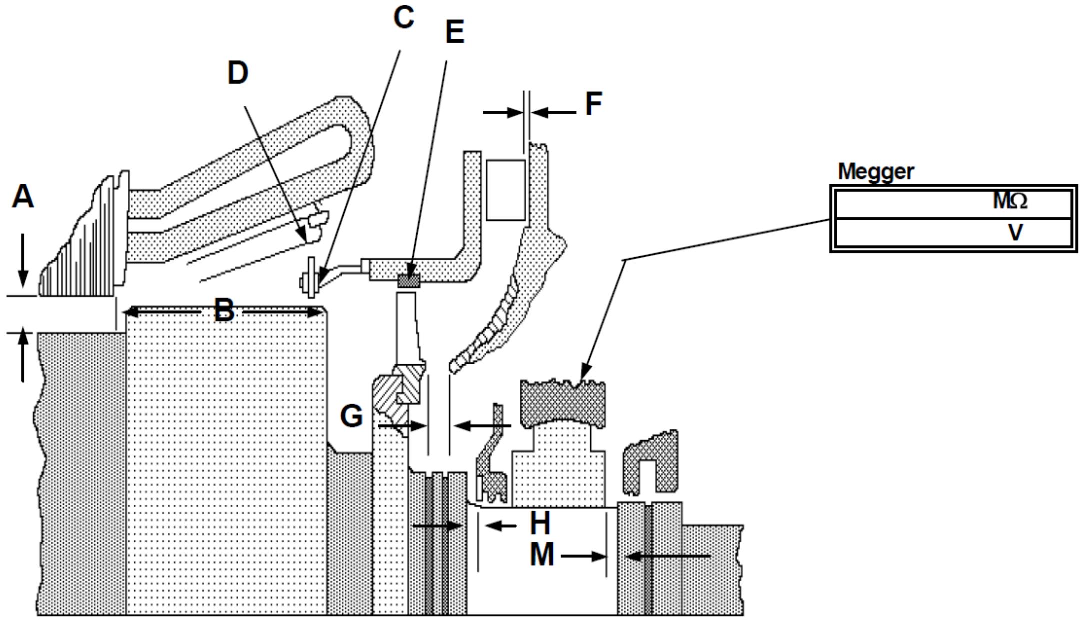
ALSTOM

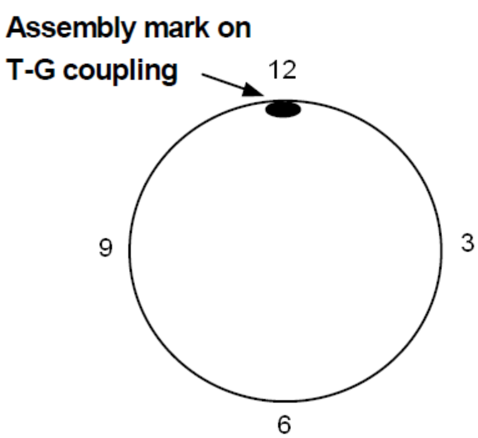
Document No. **UTGE 622037** Rev. - Sheet No. 1 No.of sh. 1

* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title: **Standard GE Generator Rotor Clearances - NDE**





Clearances	12:00	3:00	6:00	9:00
A				
B				
C				
D				
E	.110	.132	.075	.106
F				
G				
H				
M				

Comments:

Test Decision: (as required/acc.to specification)	**Accepted*** ☐ **Rejected*** ☐ **NC-Report*** ☐ **Rework*** ☐	Plant / unit: **Holyrood Unit 1**	
Shop* ☐ before overhaul* ☐ Site* ☐ after overhaul* ☐	NCR No.*	Product designation: Generator "As Found"	Quantity
Checked By**: Bill Cochran 5-31-2012		Ident No. / Rev.	Power station designation
Approved By**: James George 5-31-2012		I & T plan No.: UTGE622040 / Rev.: A	Test step: 3.0010 / Mat. test. No.
Authority / Customer**		Order No.	Factory Order

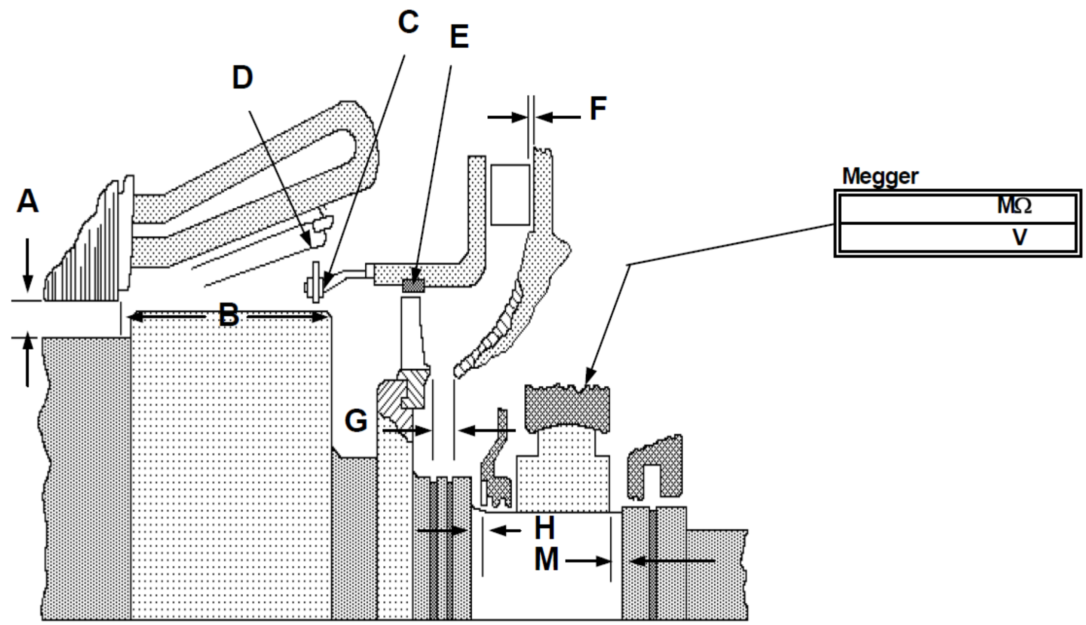
Resp. dept.	Prepared**	Checked**	Released**	Doc.-Type	Language
Generator Eng	C Fortier 21-May-2012	J Jensen 21-May-2012	J Fiaux 21-May-2012	TC	EN

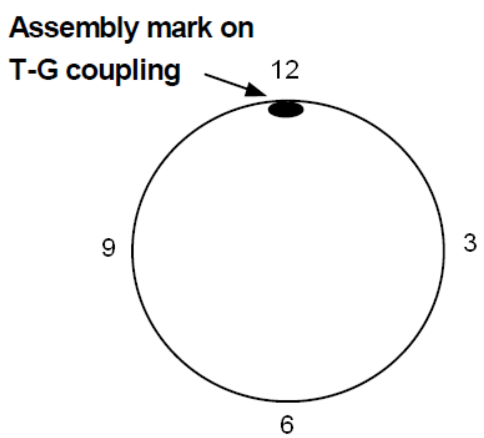
	Document No.	Rev.	Sheet No.	No.of sh.
ALSTOM	**UTGE 622038**	-	1	1

* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate

Title: **Standard GE Generator Rotor Clearances - NDE**





Clearances	12:00	3:00	6:00	9:00
A				
B				
C				
D				
E	.104	.123	.097	.144
F				
G				
H				
M				

Comments:

Test Decision: (as required/acc.to specification)
Accepted* ☐ **Rejected*** ☐
NC-Report* ☐ **Rework*** ☐

Shop* ☐ before overhaul* ☐
Site* ☐ after overhaul* ☐
NCR No.*

Checked By** Joe Pitcher 7-3-2012

Approved By** James George 7-3-2012

Authority / Customer**

Plant / unit: **Holyrood Unit 1**

Product designation: Generator "As Left"

Quantity:

Ident No.: | Rev.: | Power station designation:

I & T plan No.: UTGE622040 | Rev.: A | Test step: 9.0010 | Mat. test. No.:

Order No.: | Factory Order:

Resp. dept.	Prepared**	Checked**	Released**	Doc.-Type	Language
Generator Eng	C Fortier 21-May-2012	J Jensen 21-May-2012	J Fiaux 21-May-2012	TC	EN

ALSTOM

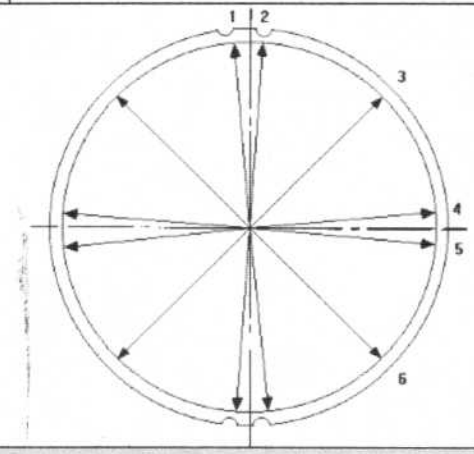
Document No.	Rev.	Sheet No.	No.of sh.
UTGE 622038	-	1	1

* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate	Title: Standard GE Hydrogen Seal System Checks

INSPACTIONS & CHECKS

				CODE
Main Seal Oil Pump		Regulating Valves,		X - Work Carried Out
Emerg. Seal Oil Pump		Oil Filters,		N - Not Done
Gas Side Drain Float,		Seal Oil Pressure Gauges		NA - Not Applicable
Trap and Valves	X	at Unit Centerline		C - See Comments
Vacuum Pump		High Level Alarm on		V - Visual Inspection
Drain Enlargement	X	Hydrogen Detraining Tank		S - Satisfactory
Relief Valves		Gauge Calibration		U - Unsatisfactory
Liquid Detectors and		Seal Casing Assembly		
Alarm		* Joint Clearances	X	
Auto Pump Start &		* Oil Grooves Clear?	X	
Alarm Test				



SEAL MEASUREMENTS

POSTION	DRIVE END		NON DRIVE END	
	AIR	HYDROGEN	AIR	HYDROGEN
1	13,008	13.013	13.000	13.003
2	13.008	13,013	13,003	13.003
3	13,005	13,009	13.005	13.007
4	13.005	13.009	13.006	13,009
5	13,001	13.005	13.006	13.010
6	13.001	13.005	13.006	13,006
AVERAGE	13,005	13,009	13.004	13.006
SHAFT DIA	12,999	12.999	12.098	12.099
CLEARANCE	,006"	.010"	.006	.007

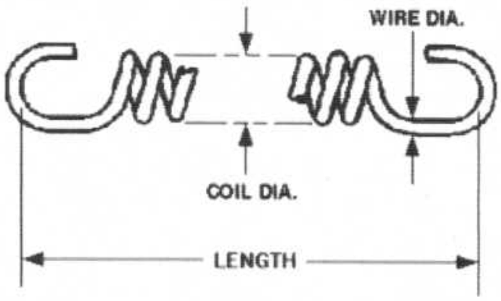
Test Decision: (as required/acc.to specification) Accepted* ☐ Rejected* ☐ NC-Report* ☐ Rework* ☐	Plant / unit: HOLYROOD UNIT 1	
Shop* ☐ before overhaul* ☐ Site* ☐ after overhaul* ☐ NCR No.*	Product designation: HYDROGEN SEAL SYSTEM	Quantity
Checked By**: BILL COCHRAN 6-18-2012	Ident No. Rev.	Power station designation
Approved By**: JAMES GEORGE 6-18-2012	I & T plan No.: UTGE622040 Rev.: A	Test step: 4.0080 Mat. test. No.
Authority / Customer**	Order No.	Factory Order

Resp. dept.	Prepared**	Checked**	Released**	Doc.-Type	Language
Generator Eng	C Fortier 24-May-2012	J Jensen 24-May-2012	J Fiaux 24-May-2012	TC	EN

	Document No.	Rev.	Sheet No.	No.of sh.
ALSTOM	UTGE 622045	-	1	2

* Mark/Fill in if applicable ** Name / dept. / date / initials

Test Certificate	Title: **Standard GE Hydrogen Seal System Checks**



HYDROGEN SEAL SPRING MEASUREMENTS				
	DRIVE END		NON DRIVE END	
	UPPER	LOWER	UPPER	LOWER
LENGTH	22.062	22.000	22.062	22.000
WIRE DIA	.136	.136	.136	.136
COIL DIA	.616	.616	.615	.615
GRADIENT	N/A	N/A	N/A	N/A

TESTING DATA	
Seal Oil Flow	GPM
Hydrogen Pressure	PSI
Unit Speed	RPM

SYSTEM TYPE (circle one)
(Vacuum / Scavaging)

Comments: "AS FOUND" AND "AS LEFT" READINGS

Doc. type:	Language:	Rev.: -	No. of sh.:
TC	en	-	2

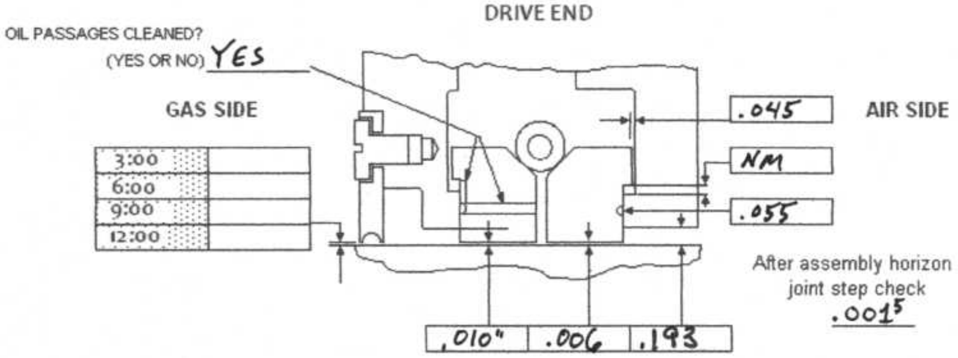
ALSTOM	Document No.: **UTGE622045**	Sheet No.: 2

KWE-IS 50310201 P2

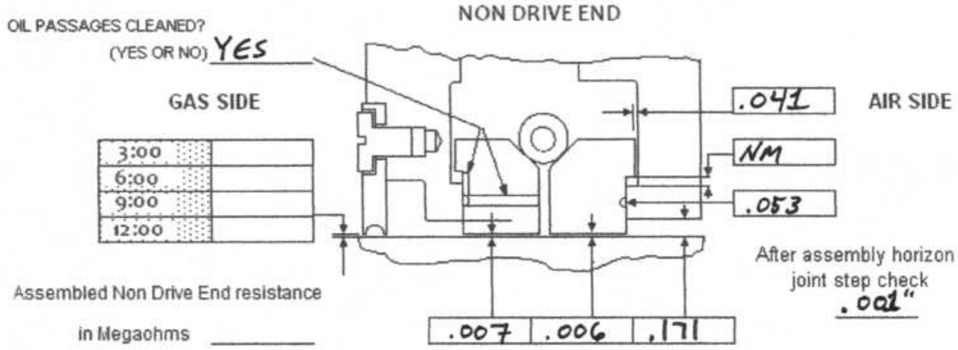
Test Certificate	Title: Standard GE Hydrogen Seal Checks

INSPECTIONS & CHECKS				CODE	
Blue Check	X			X	Work Carried Out
Seal Joint Check	X			N	Not Done
				NA	Not Applicable
				C	See Comments
				V	Visual Inspection
				MP	Mag. Particle
				UT	Ultrasonic
				PT	Penetrant

DRIVE END



NON DRIVE END



Assembled Non Drive End resistance in Megaohms ________

Comments:

Test Decision: (as required/acc.to specification)	Accepted* ☐ Rejected* ☐ NC-Report* ☐ Rework* ☐	Plant / unit: HOLYROOD UNIT 1	
Shop* ☐ before overhaul* ☐ Site* ☐ after overhaul* ☐	NCR No.*	Product designation: ~~Coupling~~ GENERATOR	Quantity
Checked By**: BILL COCHRAN 7-7-2012		Ident No. / Rev.	Power station designation
Approved By**: JAMES GEORGE		I & T plan No.: UTGE 622040 / Rev.: A	Test step: 10.007 / Mat. test. No.
Authority / Customer**		Order No.	Factory Order

Resp. dept.	Prepared**	Checked**	Released**	Doc.-Type	Language
Generator Eng	C Fortier 24-May-2012	J Jensen 24-May-2012	J Fiaux 24-May-2012	TC	EN
ALSTOM		Document No. UTGE 622044	Rev. -	Sheet No. 1	No.of sh. 1

* Mark/Fill in if applicable ** Name / dept. / date / initials

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # Gen001
Subject: Generator Journal #4 Electrolysis		Sheet 1/3 ISSUE #

Station: Holyrood	Unit #1	ALSTOM Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☐ Gen. Rotor ☒ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; # PICTURES # RECORD SHEETS	
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐ Signature: Date:
Programme Reference:		
Quality Plan Reference:		

SITE INSPECTION

Report

A small amount of Electrolysis was found on the #4 journal. One of the grounding brushes was found worn. The spring of that brush holder had no tension on it. The journal where the brush contact occurs was found with oxidation.

Recommendations

1. The #4 journal should be inspected during future outages to monitor the condition.
2. The rotor should be strap lapped in the area where the brushes ride to ensure good contact.
3. The brushes and brush holders should be replaced as needed. New brushes and holders are being installed during this outage
4. Shaft grounding maintenance should be performed per OEM specification

Schedule Impact Yes ☐ No ☒

Cost Impact Yes ☐ No ☒

Alstom's Engineering Department Recommendations

N/A

Customer's Response

Written By:	James George	Position: Technical Field Advisor	Date: 6/14/2012
Distribution For Action:	Client ☒	Engineering ☐	Project Manager ☐
Distribution For Information:	Client ☒	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # Gen001
Subject: Generator Journal #4 Electrolysis		Sheet 2/3 ISSUE #
Station: Holyrood	Unit #1	ALSTOM Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☐ Gen. Rotor ☒ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; # PICTURES # RECORD SHEETS	
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Programme Reference:		
Quality Plan Reference:		Signature: Date:

Electrolysis on journal

Written By:	James George	Position: Technical Field Advisor	Date: 6/14/2012
Distribution For Action:	Client ☒	Engineering ☐	Project Manager ☐
Distribution For Information:	Client ☒	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)		IIR # Gen001
Subject: Generator Journal #4 Electrolysis			Sheet 3/3 ISSUE #
Station: Holyrood		Unit #1	ALSTOM
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☐ Gen. Rotor ☒ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:		Attachments; # PICTURES # RECORD SHEETS	Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Contract #	Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Programme Reference:			
Quality Plan Reference:			Signature: Date:

Oxidation on generator rotor

Written By:	James George	Position: Technical Field Advisor	Date: 6/14/2012
Distribution For Action:	Client ☒	Engineering ☐	Project Manager ☐
Distribution For Information:	Client ☒	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # Gen002
Subject: Generator Seal Oil System Condition		Sheet 1/3 ISSUE #

Station: Holyrood		Unit #1	ALSTOM
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☒ Gen. Rotor ☒ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:		Attachments; # PICTURES # RECORD SHEETS	Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Contract #	Main Report #		CLIENT
Programme Reference:			Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Quality Plan Reference:			Signature: Date:

SITE INSPECTION

Report

Dirt and sludge was found in the seal oil system in the hydrogen seal casings and oil return lines. The hydrogen seal rings were found with scoring in several areas. The hydrogen seal journals were also found scored.

Recommendations

1. The hydrogen seal system should be flushed.
2. Clean Auxilary air detraining tank interior
3. Clean the drain piping through cleanout openings
4. Clean Hydrogen detraining tank interior
5. Clean Loop Seals
6. Clean hydrogen seal vacuum tank interior
7. Clean Seal oil float trap

Schedule Impact Yes ☐ No ☒

Cost Impact Yes ☐ No ☒

Alstom's Engineering Department Recommendations

N/A

Customer's Response

Written By:	James George	Position: Technical Field Advisor	Date: 6/15/2012
Distribution For Action:	Client ☒	Engineering ☐	Project Manager ☐
Distribution For Information:	Client ☒	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # Gen002
Subject: Generator Seal Oil System Condition		Sheet 2/3 ISSUE #
Station: Holyrood	Unit #1	ALSTOM
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☒ Gen. Rotor ☒ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; # PICTURES # RECORD SHEETS	Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Programme Reference:		
Quality Plan Reference:		Signature: Date:

Dirt and sludge in hydrogen seal casings and on rings

Written By:	James George	Position: Technical Field Advisor	Date: 6/15/2012
Distribution For Action:	Client ☒	Engineering ☐	Project Manager ☐
Distribution For Information:	Client ☒	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # Gen002
Subject: Generator Seal Oil System Condition		Sheet 3/3 ISSUE #

Station: Holyrood	Unit #1	ALSTOM Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☒ Gen. Rotor ☒ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; # PICTURES # RECORD SHEETS	
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐ Signature: Date:
Programme Reference:		
Quality Plan Reference:		

Scoring on hydrogen seal ring

Written By:	James George	Position: Technical Field Advisor	Date: 6/15/2012
Distribution For Action:	Client ☒	Engineering ☐	Project Manager ☐
Distribution For Information:	Client ☒	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # Gen003
Subject: Generator Collector Rings out of round		Sheet 1/2 ISSUE #

Station: Holyrood	Unit #1	ALSTOM Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☐ Gen. Rotor ☒ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; # PICTURES # RECORD SHEETS	
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Programme Reference:		
Quality Plan Reference:		Signature: Date:

SITE INSPECTION

Report

The dimensional measurements taken on the collector rings of the unit 1 generator field were found to be out of round by approximately .007". When grinding the collector rings according to "elliptical patterns to brush vibrations", the rings will be elliptical, however, 7 mils seems excessive. The readings were found as follows:

Diameters Outboard Ring

Ring Number	Diameters A-E	B-F	C-G	D-H	Max	Min	Out of Round
1	13.278"	13.278"	13.279"	13.277"	13.279"	13.277"	2 Mils
2	13.270"	13.272"	13.273"	13.274"	13.274"	13.270"	4 Mils
3	13.274"	13.271"	13.268"	13.270"	13.274"	13.268"	6 Mils
4	13.273"	13.269"	13.270"	13.268"	13.273"	13.268"	5 Mils
5	13.268"	13.272"	13.273"	13.273"	13.273"	13.268"	5 Mils
6	13.274"	13.276"	13.275"	13.281"	13.281"	13.274"	7 Mils

Diameters Inboard Ring

Ring Number	Diameters A-E	B-F	C-G	D-H	Max	Min	Out of Round
1	13.314"	13.311"	13.314"	13.313"	13.314"	13.311"	3 Mils
2	13.297"	13.303"	13.303"	13.299"	13.303"	13.297"	6 Mils
3	13.306"	13.306"	13.305"	13.300"	13.306"	13.300"	6 Mils
4	13.298"	13.300"	13.300"	13.299"	13.300"	13.298"	2 Mils
5	13.310"	13.307"	13.312"	13.311"	13.312"	13.307"	5 Mils
6	13.311"	13.311"	13.315"	13.312"	13.315"	13.311"	4 Mils

Written By:	James George	Position: Technical Field Advisor	Date: 6/20/2012

Distribution For Action: Client ☐ Engineering ☒ Project Manager ☐

Distribution For Information: Client ☒ Engineering ☐ Project Manager ☐

CRN Reference no: (if applicable)

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)		IIR # Gen003
Subject: Generator Collector Rings out of round			Sheet 2/2 ISSUE #
Station: Holyrood		Unit #1	ALSTOM Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☐ Gen. Rotor ☒ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:		Attachments; # PICTURES # RECORD SHEETS	
Contract #	Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐ Signature: Date:
Programme Reference:			
Quality Plan Reference:			

Recommendations

- Grind and polish rings according to OEM procedure.

Schedule Impact Yes ☒ No ☐

Cost Impact Yes ☐ No ☒

Alstom's Engineering Department Recommendations

Customer's Response

Customer agreed to grind the collector rings and clean up the shaft grounding brush area.

Written By:	James George	Position: Technical Field Advisor	Date: 6/20/2012
Distribution For Action:	Client ☐	Engineering ☒	Project Manager ☐
Distribution For Information:	Client ☒	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # Gen004
Subject: Generator Belly Band Tightness		Sheet 1/4 ISSUE #

Station: Holyrood	Unit #1	ALSTOM Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☒ Gen. Rotor ☐ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; # PICTURES # RECORD SHEETS	
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Programme Reference:		
Quality Plan Reference:		Signature: Date:

SITE INSPECTION

Report

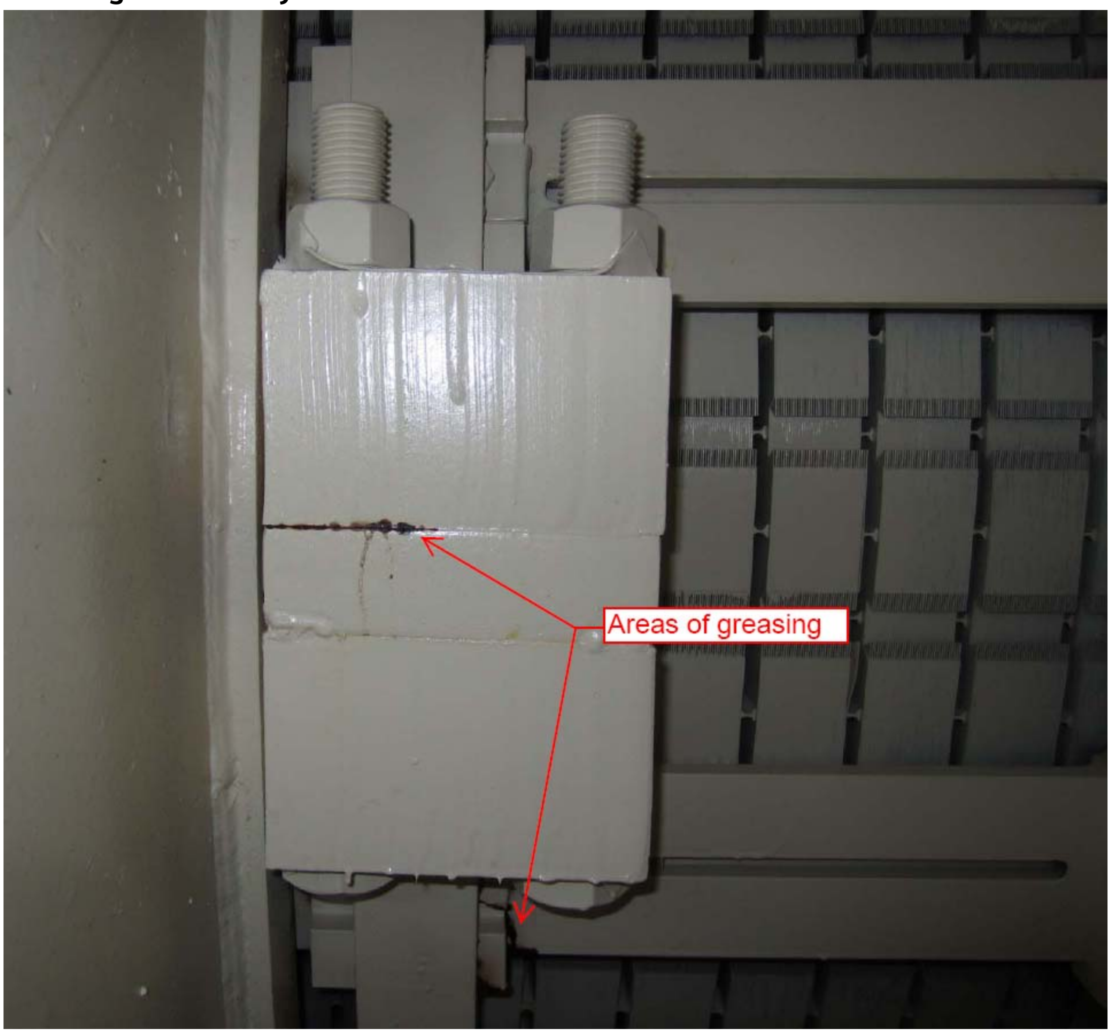
The front belly band of the stator was found with some greasing and signs of movement. Signs of movement as shown:

Written By:	James George	Position: Technical Field Advisor	Date: 6/20/2012
Distribution For Action:	Client ☐	Engineering ☒	Project Manager ☐
Distribution For Information:	Client ☒	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # Gen004
Subject: Generator Belly Band Tightness		Sheet 2/4 ISSUE #

Station: Holyrood	Unit #1	ALSTOM
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☒ Gen. Rotor ☐ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; # PICTURES # RECORD SHEETS	Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Contract # / Main Report #		CLIENT
Programme Reference:		Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Quality Plan Reference:		Signature: Date:

Greasing on the belly band as shown:

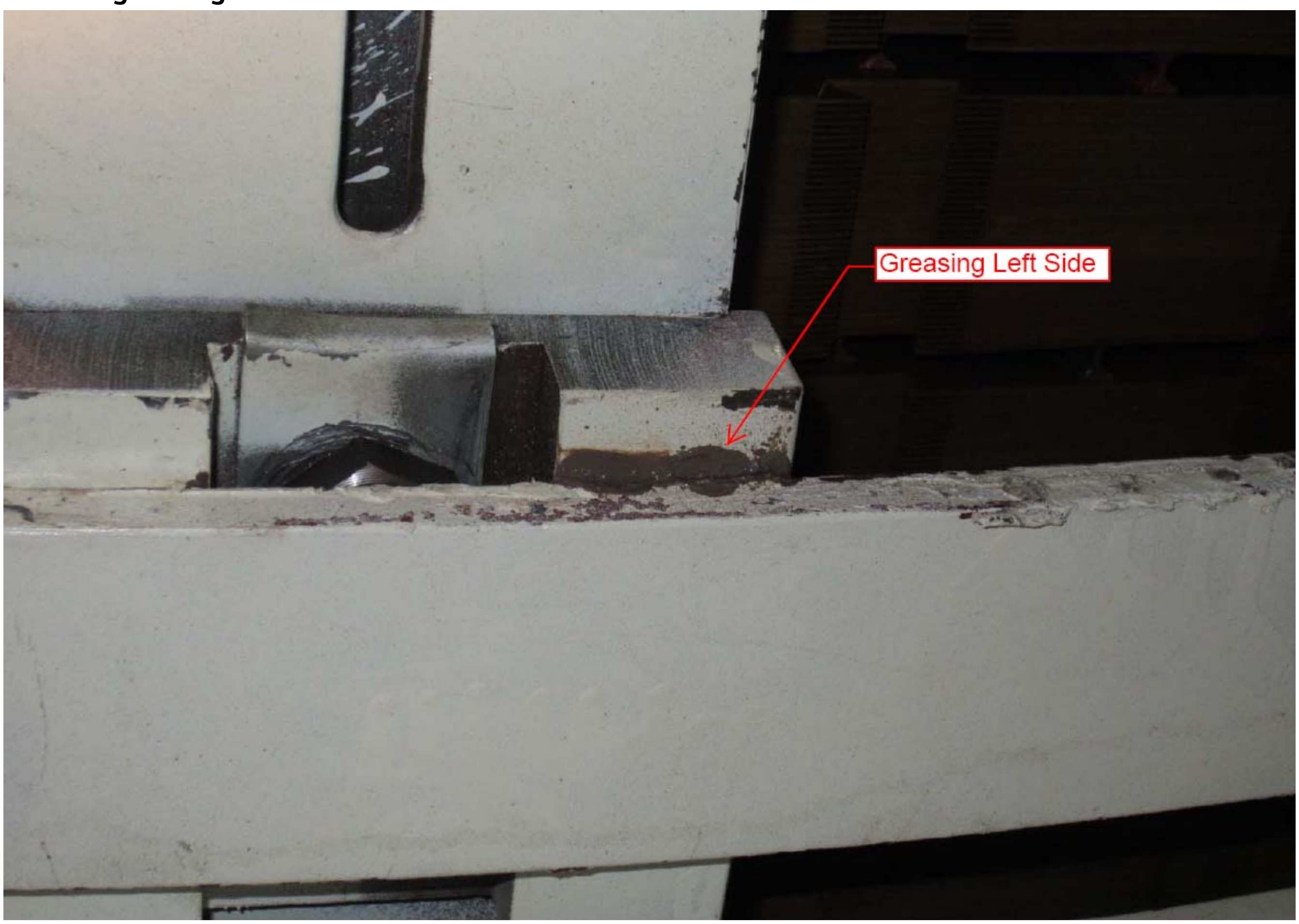


Written By:	James George	Position: Technical Field Advisor	Date: 6/20/2012
Distribution For Action:	Client ☐	Engineering ☒	Project Manager ☐
Distribution For Information:	Client ☒	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # Gen004

Subject: Generator Belly Band Tightness		Sheet 3/4 ISSUE #
Station: Holyrood	Unit #1	ALSTOM Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☒ Gen. Rotor ☐ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; # PICTURES # RECORD SHEETS	
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Programme Reference:		
Quality Plan Reference:		Signature: Date:

Further greasing on the left side:



Written By:	James George	Position: Technical Field Advisor	Date: 6/20/2012
Distribution For Action:	Client ☐	Engineering ☒	Project Manager ☐
Distribution For Information:	Client ☒	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # Gen004
Subject: Generator Belly Band Tightness		Sheet 4/4 ISSUE #

Station: Holyrood	Unit #1	ALSTOM
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☒ Gen. Rotor ☐ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; # PICTURES # RECORD SHEETS	Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐
Programme Reference:		
Quality Plan Reference:		Signature: Date:

Recommendations

- Tight belly band now or during next inspection.

Schedule Impact Yes ☐ No ☒

Cost Impact Yes ☒ No ☐

Alstom's Engineering Department Recommendations

Customer's Response

Written By:	James George	Position: Technical Field Advisor	Date: 6/20/2012
Distribution For Action:	Client ☐	Engineering ☒	Project Manager ☐
Distribution For Information:	Client ☒	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

POWER ALSTOM	STG INTERIM INSPECTION REPORT (IIR)	IIR # Gen005

Subject: Hydrogen Seal Casing Oil Deflector	Sheet 1/1 ISSUE #

Station: Holyrood	Unit #1	ALSTOM Conformity: Yes ☐ No ☐ Design Response Required: Yes ☐ No ☐ Design Accepted: Yes ☐ No ☐
Component Inspected: Casing ☐ Rotor ☐ HP ☐ IP ☐ LP1 ☐ LP2 ☐ LP3 ☐ Auxiliaries ☐ BFPT ☐ Stator ☒ Gen. Rotor ☐ Auxiliaries ☐ Exciter ☐ Valves ☐ MSR ☐ Controls ☐ Piping ☐ Component Serial Number:	Attachments; # PICTURES # RECORD SHEETS	
Contract # / Main Report #		CLIENT Client Accepts Recommendation: Yes ☐ No ☐ Client Accepts 'As Found': Yes ☐ No ☐ Signature: Date:
Programme Reference:		
Quality Plan Reference:		

SITE INSPECTION

Report

Both hydrogen seal casing oil deflectors were found worn with excessive clearance. The TE hydrogen seal casing oil deflector had .075" diametrical clearance and the CE hydrogen seal casing oil deflector had .049" clearance. The maximum diametrical clearance at the oil deflectors should be .040" clearance.

Recommendations

- Replace or repair oil deflectors during next generator outage.

Schedule Impact Yes ☐ No ☒

Cost Impact Yes ☐ No ☒

Alstom's Engineering Department Recommendations

Customer's Response

Customer agreed to re-install the existing oil deflectors and replace at next outage

Written By:	James George	Position: Technical Field Advisor	Date: 7/4/2012
Distribution For Action:	Client ☒	Engineering ☐	Project Manager ☐
Distribution For Information:	Client ☒	Engineering ☐	Project Manager ☐
CRN Reference no: (if applicable)			

TEAM® Industrial Services
TISI Canada Inc.

ISO 9001:2008

MAGNETIC PARTICLE EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL Hydro	Acceptance: ASME SECTION 8
Date Of Examination: 16 August 2011	Procedure: MT ASME 1
Work Location/Address: Holyrood, NL	Technique: ASME V
Part Description: Unit 1 Turbine Rotor	P.O. Number: 19101 OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [X]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
N/A	N/A	N/A	N/A

Scope: To perform a fluorescent magnetic particle inspection on unit 1 turbine rotor fan blades.

Results: As requested by Alstom 100% of all fan blades were inspected using the wet fluorescent method of MPI .At the time of inspection no indications were found all areas are acceptable to code.

Note: Blades 2 & 3 on the HP section have moderate to heavy pitting throughout.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
N/A	N/A	/N/A
Min black light intensity is 1000 microwatts: @ 15" from the surface of the part. Y [x] N [ ] @ surface OK [x] mw/cm2: [x]	*** Document black and white light meters S/N and calibration dates:**	Minimum white light intensity is 100 ft candles at the surface of the part. **OK** [x] Ft candles:[ ]

Magnetizing Equipment			**Inspection Medium**		**Demagnetize**	
Equipment	Current	Serial No.	Product	Batch No.	Yes	No x
Yoke	A/C	16267	Lumor J	4207		
					No. of Oersteds	
Additional Equipment Used Incl lighting equipment details): Black Light Serial No. **16476**					**N/A**	

TEAM TECHNICIAN: Print Name: Glenn Melindy Signature:	**Certification:** 10096 ACCP Level II [ ] CGSB 48.9712 Level 2 [x] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE: Print Name	Signature Date

Branch Office

TEAM® Industrial Services
TISI Canada Inc.

ISO 9001:2008

MAGNETIC PARTICLE EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL Hydro	Acceptance: ASME SECTION 8
Date Of Examination: 16 August 2011 Wrong Date	Procedure: MT ASME 1
Work Location/Address: Holyrood, NL	Technique: ASME V
Part Description: Unit 1 Turbine Rotor	P.O. Number: 19101 OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [X]**

Part/Assy No.: N/A	**Dwg No.:** N/A	**Heat No.:** N/A	**Pattern No.:** N/A

Scope: To perform a fluorescent magnetic particle inspection on unit 1 turbine rotor fan blades.

Results: As requested by Alstom 100% of all fan blades were inspected using the wet fluorescent method of MPI .At the time of inspection no indications were found all areas are acceptable to code.

Note: Blades 2 & 3 on the HP section have moderate to heavy pitting throughout.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
N/A	N/A	/N/A
Min black light intensity is 1000 microwatts: @ 15" from the surface of the part. Y [x] N [ ] @ surface OK [x] mw/cm2: [x]	*** Document black and white light meters S/N and calibration dates:**	Minimum white light intensity is 100 ft candles at the surface of the part. **OK** [x] Ft candles:[ ]

Magnetizing Equipment			**Inspection Medium**		**Demagnetize**	
Equipment	Current	Serial No.	Product	Batch No.	Yes	No x
Yoke	A/C	16267	Lumor J	4207		
					No. of Oersteds	
Additional Equipment Used Incl lighting equipment details): Black Light Serial No. **16476**					**N/A**	

TEAM TECHNICIAN: Print Name: Glenn Melindy	Signature:	**Certification:** 10096 ACCP Level II [ ] CGSB 48.9712 Level 2 [x] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE:	Print Name: John Adams	Signature: Date: June 15/12

TEAM® Industrial Services
TISI Canada Inc.

ISO 9001:2008 IS

MAGNETIC PARTICLE EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL Hydro	Acceptance: ASME Section VIII
Date Of Examination: 2012/June/16	Procedure: MT.ASME.1 Rev. 15
Work Location/Address: Holyrood, NL	Technique: Fluorescent
Part Description: Unit 1 Turbine Diaphragms	P.O. Number: 19101OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [X]**

Part/Assy No.:	**Dwg No.:**	**Heat No.:**	**Pattern No.:**
n/a	n/a	n/a	n/a

Scope: To perform fluorescent magnetic particle inspection on Unit 1 turbine diaphragms

Results: As requested by Alstom, wet fluorescent magnetic particle inspection was performed on Unit 1 lower portion of turbine diaphragms GE5, 5TE(one side only), 3GE(one side only), 2TE, GE2(one side only) and 4TE(one side only). At time of inspection, no indications were found and accepted to code.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
6	6	0
Min black light intensity is 1000 microwatts: @ 15" from the surface of the part. **Y** [X] **N** [ ] @ surface **OK** [X] mw/cm2: [ ]	*** Document black and white light meters S/N and calibration dates:**	Minimum white light intensity is 100 ft. candles at the surface of the part. **OK** [X] Ft candles:[ ]

Magnetizing Equipment			**Inspection Medium**		**Demagnetize**	
Equipment	Current	Serial No.	Product	Batch No.	Yes	No x
Magwerks	A/C	080521	Lumor J	4207		
Magnetic Penetrameter		84261			No. of Oersteds	
Additional Equipment Used (Incl lighting equipment details): Black Light Serial # 16476					**N/A**	

TEAM TECHNICIAN: Print Name: Kristofer Jacobs Signature:	**Certification: 13562** ACCP Level II [ ] CGSB 48.9712 Level 2 [X] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE:	Print Name Signature Date

Branch Office

MAGNETIC PARTICLE EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL HYDRO	Acceptance: ASME Section VIII
Date Of Examination: 2012/June/18 and June 19	Procedure: MT.ASME.1 Rev 15
Work Location/Address: Holyrood, NL	Technique: Fluorescent
Part Description: Unit 1 turbine Diaphragms	P.O. Number: 19101OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
n/a	n/a	n/a	n/a

Scope: **To perform Magnetic Particle inspection of Unit 1 diaphragms**

This report covers the magnetic particle examination on the above components as requested by Alstom.

Results:

Wet fluorescent magnetic particle inspection was performed on Unit 1 turbine diaphragms 3GE lower (1 side), GE2 lower (1 side), 4TE lower (1 side), 5TE lower (1 side), GE4 lower, 3TL lower, 5TE Upper, 15 lower, 9 lower. At the time of inspection no indications were found and parts accepted to code.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
10	10	0
Min black light intensity is 1000 microwatts: @ 15" from the surface of the part. **Y** [X] **N** [ ] @ surface **OK** [ ] mw/cm2: [ ]	*** Document black and white light meters S/N and calibration dates:**	Minimum white light intensity is 100 ft candles at the surface of the part. **OK** [X] Ft candles:[ ]

Magnetizing Equipment			**Inspection Medium**		**Demagnetize**	
Equipment	Current	Serial No.	Product	Batch No.	Yes	No x
Magwerks	A/C	080521	Lumor J	4207		
Magnetic Penetrameter		84261			No. of Oersteds	
Additional Equipment Used (Incl lighting equipment details): Black light Serial No. 16476					**n/a**	

This Certificate or Report is valid only for that work which was specifically requested. The Company is not responsible for any views or opinions expressed by employees performing this work which fall outside the exact terms of reference. All certificates and/or reports are the result of work performed in conformance with applicable specifications and standards to the best of our ability and intent. However, the company will not be responsible for deviations within the normal limits of accuracy in accordance with the standard practices. **Final Code acceptance shall require Client/Manufacture representatives signature.**

TEAM TECHNICIAN: Print Name: John Clarke	Signature: John Clarke	**Certification: 4397** CGSB 48.9712 Level 2 [x] ACCP Level II [ ] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE:	Print Name	Signature / Date

TEAM Industrial Services
TISI Canada Inc.

ISO 9001:2008 IS

MAGNETIC PARTICLE EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL HYDRO	Acceptance: ASME Section VIII
Date Of Examination: 2012/June 20th , 21st and 22nd	Procedure: MT.ASME.1 Rev 15
Work Location/Address: Holyrood, NL	Technique: Fluorescent
Part Description: Unit 1 turbine Diaphragms	P.O. Number: 19101OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
n/a	n/a	n/a	n/a

Scope: **To perform Magnetic Particle inspection of Unit 1 diaphragms**

This report covers the magnetic particle examination on the above components as requested by Alstom.

Results:

Wet fluorescent magnetic particle inspection was performed on Unit 1 turbine lower diaphragms 1GE, 1TE, 8, 5, 7, 6, 2, 3, 4, 17, 15, 13, 12, 11, 14, 16. At time of inspection no indications found.

Wet fluorescent magnetic particle inspection was performed on unit 1 turbine upper diaphragms 14, 11, 13, 12, 17, 2, 3, 4, 16, 5, 6, 7, 9, TL1, GL1, 8. At time of inspection no indications found.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
32	32	0
Min black light intensity is 1000 microwatts: @ 15" from the surface of the part. Y [X] N [ ] @ surface **OK** [ ] mw/cm2: [ ]	*** Document black and white light meters S/N and calibration dates:**	Minimum white light intensity is 100 ft candles at the surface of the part. **OK** [X] Ft candles:[ ]

Magnetizing Equipment			**Inspection Medium**		**Demagnetize**	
Equipment	Current	Serial No.	Product	Batch No.	Yes	No x
Magwerks	A/C	080521	Lumor J	4207		
Magnetic Penetrameter		84261			No. of Oersteds	
Additional Equipment Used (Incl lighting equipment details): Black light Serial No. 16476					**n/a**	

 Final Code acceptance shall require Client/Manufacture representatives signature.

TEAM TECHNICIAN: Print Name: John Clarke	Signature: John Clarke	**Certification: 4397** ACCP Level II [ ] CGSB 48.9712 Level 2 [x] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE: Print Name: John Adams	Signature: [signature]	Date: June 25/12

TEAM® Industrial Services
TISI Canada Inc.

ISO 9001:2008 IS

MAGNETIC PARTICLE EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL HYDRO	Acceptance: ASME Section VIII
Date Of Examination: 2012/June 26th	Procedure: MT.ASME.1 Rev 15
Work Location/Address: Holyrood, NL	Technique: Fluorescent
Part Description: Unit 1 turbine 1st stage nozzle	P.O. Number: 19101OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
n/a	n/a	n/a	n/a

Scope: To perform Magnetic Particle inspection of Unit 1 1st stage nozzle

This report covers the magnetic particle examination on the above components as requested by Alstom.

Results:

Wet fluorescent magnetic particle inspection was performed on Unit 1 turbine 1st stage upper nozzle
At time of inspection no indications found.

Wet fluorescent magnetic particle inspection was performed on unit 1 turbine 1st stage lower nozzle
At time of inspection no indications found.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
2	2	0
Min black light intensity is 1000 microwatts: @ 15" from the surface of the part. Y [X] N [ ] @ surface OK [ ] mw/cm2: [ ]	*** Document black and white light meters S/N and calibration dates:**	Minimum white light intensity is 100 ft candles at the surface of the part. OK [X] Ft candles:[ ]

Magnetizing Equipment			**Inspection Medium**		**Demagnetize**	
Equipment	Current	Serial No.	Product	Batch No.	Yes	No x
Yoke	A/C	144	Lumor J	4207		
Magnetic Penetrameter		84261			No. of Oersteds	
Additional Equipment Used (Incl lighting equipment details): Black light Serial No. 16476					**n/a**	

This Certificate or Report is valid only for that work which was specifically requested. The Company is not responsible for any views or opinions expressed by employees performing this work which fall outside the exact terms of reference. All certificates and/or reports are the result of work performed in conformance with applicable specifications and standards to the best of our ability and intent. However, the company will not be responsible for deviations within the normal limits of accuracy in accordance with the standard practices. **Final Code acceptance shall require Client/Manufacture representatives signature.**

TEAM TECHNICIAN: Print Name: John Clarke	Signature: John Clarke	**Certification: 4397** CGSB 48.9712 Level 2 [x]	ACCP Level II [ ] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE:	Print Name	Signature	Date

Branch Office

TEAM® Industrial Services
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ULTRASONIC EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL Hydro	Acceptance: ASME VIII
Date/Time: 25 June 2012	Procedure: UT.ASME 3 Rev: 8
Work Location/Address: Holyrood, NL	Technique: Longitudinal
Part Description: Horizontal Joint Bolting – **High Pressure Bolts**	P.O. Number: 19101OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
N/A	59E129BR	N/A	N/A

Scope: **Unit 1 – Turbine**

Ultrasonic Inspection to be carried out on Unit 1 Turbine- Horizontal Joint **High Pressure Bolts.**
(No. 1- 116 as per Drawing # 592E129BR Sheet 1)

Results:

An Ultrasonic Inspection was carried out as per scope in accordance with acceptance and procedure.

A rejectable indication was found on No. 40 bolt at a depth of 8.60" inches. No other relevant Indications were found on the remaining bolts in accordance with code.

Bolt Length: 20.45" inches

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
116	115	1

Scan: Longitudinal/ Zero Degree

Surface Finish: Smooth

ULTRASONIC EQUIPMENT				TRANSDUCER			
Make	Model	S/N	Cal. Date	Angle	Size	Frequency	S/N
Olympus	Epoch 600	120343804	April 2012	0 Deg	0.250	5.0 Mhz	614504

Calibration Block: Step-wedge 0.100-0.500"	**Serial No.:** 08-7638
Couplant: Exosen 30	**Batch No.:** 29110301

TEAM TECHNICIAN: Print Name **Terry Oliver**	Signature	**Certification:** **11416** ACCP Level II [ ] CGSB 48.9712 Level 2 [x] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE:	Print Name: John Adams	Signature	Date: June 27/12

TEAM® Industrial Services
TISI Canada Inc.

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ULTRASONIC EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL Hydro	Acceptance: ASME VIII
Date/Time: 26 June 2012	Procedure: UT.ASME 3 Rev: 8
Work Location/Address: Holyrood, NL	Technique: Longitudinal
Part Description: Coupling Bolts	P.O. Number: 19101OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
N/A	N/A	N/A	N/A

Scope: Unit 1 – Turbine

Ultrasonic Inspection to be carried out on Unit 1 Turbine- Coupling Bolts.

Quantity: 12

Results:

An Ultrasonic Inspection was carried out as per scope in accordance with acceptance and procedure.

No Defects found.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
-	-	0

Scan: Longitudinal/ Zero Degree

Surface Finish: Smooth

ULTRASONIC EQUIPMENT				TRANSDUCER			
Make	Model	S/N	Cal. Date	Angle	Size	Frequency	S/N
Olympus	Epoch 600	120343804	April 2012	0 Deg	0.250	5.0 Mhz	614504

Calibration Block: Step-wedge 0.100-0.500"	**Serial No.:** 08-7638
Couplant: Exosen 30	**Batch No.:** 29110301

TEAM TECHNICIAN: Print Name: Terry Oliver	Signature:	**Certification: 11416** CGSB 48.9712 Level 2 [x]	ACCP Level II [ ] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE:	Print Name: John Adams	Signature:	Date: June 27/12

TEAM® Industrial Services
TISI Canada Inc.

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ULTRASONIC EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL Hydro	Acceptance: ASME VIII
Date/Time: 26 June 2012	Procedure: UT.ASME 3 Rev: 8
Work Location/Address: Holyrood, NL	Technique: Longitudinal
Part Description: Steam Inlet Flange Bolts	P.O. Number: 19101OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
N/A	N/A	N/A	N/A

Scope: **Unit 1 – Turbine**

Ultrasonic Inspection to be carried out on Unit 1 Turbine- Steam Inlet Flange Bolts.

Quantity: 12

Results:

An Ultrasonic Inspection was carried out as per scope in accordance with acceptance and procedure.

No defects found.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
-	-	0

Scan: Longitudinal/ Zero Degree

Surface Finish: Smooth

ULTRASONIC EQUIPMENT				TRANSDUCER			
Make	Model	S/N	Cal. Date	Angle	Size	Frequency	S/N
Olympus	Epoch 600	120343804	April 2012	0 Deg	0.250	5.0 Mhz	614504

Calibration Block: Step-wedge 0.100-0.500” **Serial No.:** 08-7638

Couplant: Exosen 30 **Batch No.:** 29110301

TEAM TECHNICIAN: Print Name: Terry Oliver Signature:	**Certification:** 11416 ACCP Level II [ ] CGSB 48.9712 Level 2 [x] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE: Print Name: John Adams Signature:	Date: June 27/12

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MAGNETIC PARTICLE EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL HYDRO	Acceptance: ASME Section VIII
Date Of Examination: 2012, June 25th	Procedure: MT.ASME.1 Rev 15
Work Location/Address: Holyrood, NL	Technique: Fluorescent
Part Description: Unit 1 turbine Diaphragms	P.O. Number: 19101OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
n/a	n/a	n/a	n/a

Scope: **To perform Magnetic Particle inspection of Unit 1 diaphragms**

This report covers the magnetic particle examination on the above components as requested By Alstom.

Results:

Wet fluorescent magnetic particle inspection was performed on Unit 1 turbine upper Diaphragms T4, T3, T2, G2, G3, GE4, GE5

At the time of inspection no indications were found and the parts were accepted to code.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
7	7	0
Min. black light intensity is 1000 microwatts: @ 15" from the surface of the part. Y [X] N [ ] @ surface OK [ ] mw/cm2: [ ]	*** Document black and white light meters S/N and calibration dates:**	Minimum white light intensity is 100 ft candles at the surface of the part. **OK** [X] Ft candles:[ ]

Magnetizing Equipment			**Inspection Medium**		**Demagnetize**	
Equipment	Current	Serial No.	Product	Batch No.	Yes	No x
Magwerks	A/C	080521	Lumor J	4207		
Magnetic Penetrameter		84261			No. of Oersteds	
Additional Equipment Used (Incl lighting equipment details): Black light Serial No. 16476					n/a	

TEAM TECHNICIAN: Print Name: John Clarke	Signature: John Clarke	**Certification: 4397** CGSB 48.9712 Level 2 [x]	ACCP Level II [ ] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE:	Print Name: John Adams	Signature: John Adams	Date: June 26/12

TEAM® Industrial Services
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ULTRASONIC EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL Hydro	Acceptance: ASME VIII
Date/Time: 25 June 2012	Procedure: UT.ASME 3 Rev: 8
Work Location/Address: Holyrood, NL	Technique: Longitudinal
Part Description: Horizontal Joint Bolting – **Low Pressure Bolts**	P.O. Number: 19101OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
N/A	N/A	N/A	N/A

Scope: Unit 1 – Turbine

Ultrasonic Inspection to be carried out on Unit 1 Turbine- Horizontal Joint **Low Pressure Bolts.**

Results:

An Ultrasonic Inspection was carried out as per scope in accordance with acceptance and procedure.

No defects found.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
-	-	0

Scan: Longitudinal/ Zero Degree

Surface Finish: Smooth

ULTRASONIC EQUIPMENT				TRANSDUCER			
Make	**Model**	**S/N**	**Cal. Date**	**Angle**	**Size**	**Frequency**	**S/N**
Olympus	Epoch 600	120343804	April 2012	0 Deg	0.250	5.0 Mhz	614504

Calibration Block: Step-wedge 0.100-0.500" | **Serial No.:** 08-7638

Couplant: Exosen 30 | **Batch No.:** 29110301

Print Name	Signature		
TEAM TECHNICIAN: Terry Oliver		**Certification: 11416** ACCP Level II [ ]	CGSB 48.9712 Level 2 [x] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE:	Print Name	Signature	Date

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ULTRASONIC EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL Hydro	Acceptance: ASME VIII
Date/Time: 25 June 2012	Procedure: UT.ASME 3 Rev: 8
Work Location/Address: Holyrood, NL	Technique: Longitudinal
Part Description: Upper and Lower Control Valve Bolts	P.O. Number: 19101OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
N/A	N/A	N/A	N/A

Scope: **Unit 1 – Turbine**

Ultrasonic Inspection to be carried out on Unit 1 Turbine Upper and Lower Control Valve Bolts.

Results:

An Ultrasonic Inspection was carried out as per scope in accordance with acceptance and procedure.

No defects were found.

Bolt Length: 8.80 Inches

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
		0

Scan: Longitudinal/ Zero Degree

Surface Finish: Smooth

ULTRASONIC EQUIPMENT				TRANSDUCER			
Make	**Model**	**S/N**	**Cal. Date**	**Angle**	**Size**	**Frequency**	**S/N**
Olympus	Epoch 600	120343804	April 2012	0 Deg	0.250	5.0 Mhz	614504

Calibration Block: Step-wedge 0.100-0.500"	**Serial No.:** 08-7638
Couplant: Exosen 30	**Batch No.:** 29110301

TEAM TECHNICIAN: Print Name **Terry Oliver** Signature	**Certification: 11416** ACCP Level II [ ] CGSB 48.9712 Level 2 [x] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE: Print Name :	Signature Date

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ULTRASONIC EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL Hydro (Alstom)	Acceptance: ASME Section VIII
Date/Time: June 15, 2012	Procedure: UT ASME 1
Work Location/Address: Holy Rood, NL	Technique: ASME V
Part Description: Reheat Valves L/H & R/H - Bolts	P.O. Number: 19101 OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
N/A	N/A	N/A	N/A

Scope: **UNIT 1 Turbine**

This report covers the ultrasonic examination of unit 1 Babbitt bearings for lack of bond between the Babbitt and the backing material.

Results:

An Ultrasonic Inspection was carried out as per scope in accordance with acceptance and procedure.

No defects were found.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
N/A	N/A	N/A

Scan: Longitudinal/ Zero Degree

Surface Finish: Smooth

ULTRASONIC EQUIPMENT				TRANSDUCER			
Make	**Model**	**S/N**	**Cal. Date**	**Angle**	**Size**	**Frequency**	**S/N**
Olympus	Epoc 600	050059710	Apr 2012	0 Deg	0.250	5.0 Mhz	614504

Calibration Block: Step wedge 0.100-0.500" **Serial No.:** 08-7638

Couplant: Exosen 30 **Batch No.:** 29110301

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TEAM TECHNICIAN: Print Name **Terry Oliver** Signature	**Certification: 11416** ACCP Level II [ ] CGSB 48.9712 Level 2 [x] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE: Print Name	Signature Date

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ULTRASONIC EXAMINATION REPORT

Job Number: 52081111	Client Specifications: QA/QC
Client Name/Address: NL Hydro (Alstom)	Acceptance: ASME Section VIII
Date/Time: June 15, 2012	Procedure: UT ASME 1
Work Location/Address: Holy Rood, NL	Technique: ASME V
Part Description: Reheat Valves L/H & R/H - Bolts	P.O. Number: 19101 OB

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
N/A	N/A	N/A	N/A

Scope: **UNIT 1 Turbine**

This report covers the ultrasonic examination of unit 1 Babbitt bearings for lack of bond between the Babbitt and the backing material.

Results:

An Ultrasonic Inspection was carried out as per scope in accordance with acceptance and procedure.

No defects were found.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
N/A	N/A	N/A

Scan: Longitudinal/ Zero Degree

Surface Finish: Smooth

ULTRASONIC EQUIPMENT				TRANSDUCER			
Make	Model	S/N	Cal. Date	Angle	Size	Frequency	S/N
Olympus	Epoc 600	050059710	Apr 2012	0 Deg	0.250	5.0 Mhz	614504

Calibration Block: Step wedge 0.100-0.500"	**Serial No.:** 08-7638
Couplant: Exosen 30	**Batch No.:** 29110301

TEAM TECHNICIAN: Print Name **Terry Oliver** Signature	**Certification: 11416** ACCP Level II [ ] CGSB 48.9712 Level 2 [x] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE: Print Name John Adams	Signature Date June 15/12

Branch Office
41 Sagona Avenue, Mt. Pearl, NL A1N4P9

TEAM® Industrial Services
TISI Canada Inc.

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ULTRASONIC EXAMINATION REPORT

Job Number: 52081083	Client Specifications: QA/QC
Client Name/Address: NL Hydro (Alstom)	Acceptance: ASME Section VIII
Date/Time: June 12, 2012	Procedure: UT ASME 1
Work Location/Address: Holy Rood, NL	Technique: ASME V
Part Description: Reheat Valves L/H & R/H - Bolts	P.O. Number:

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
N/A	N/A	N/A	N/A

Scope: **UNIT 1 Turbine**

Ultrasonic Inspection to be carried out on Unit 1 Turbine Reheat Valve Bolts - Location: Left Hand and Right Hand side.

Results:

An Ultrasonic Inspection was carried out as per scope in accordance with acceptance and procedure.

No defects were found.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
40	40	0

Scan: Longitudinal/ Zero Degree

Surface Finish: Smooth

ULTRASONIC EQUIPMENT				TRANSDUCER			
Make	**Model**	**S/N**	**Cal. Date**	**Angle**	**Size**	**Frequency**	**S/N**
Panametrics	Epoch LT	050059710	30 May 11	0 Deg	0.250	5.0 Mhz	F02207

Calibration Block: Step wedge 0.100-0.500" **Serial No.:** 08-7638

Couplant: Exosen 30 **Batch No.:** 29110301

TEAM TECHNICIAN: Print Name **Glenn Melindy** Signature

Certification: 10096 ACCP Level II [ ] CGSB 48.9712 Level 2 [x] SNT-TC-1A Level II [ ]

CLIENT REPRESENTATIVE FINAL ACCEPTANCE: Print Name John Adams Signature Date June 14/12

TEAM® Industrial Services
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ULTRASONIC EXAMINATION REPORT

Job Number: 52081083	Client Specifications: QA/QC
Client Name/Address: NL Hydro	Acceptance: ASME Section VIII
Date/Time: June 12, 2012	Procedure: UT ASME 1
Work Location/Address: Holy Rood, NL	Technique: ASME V
Part Description: Main Stop Valve - Bolts	P.O. Number:

Type of Fabrication: **Weld [ ]** **Casting [ ]** **Forging [ ]** **Plate [ ]** **Other [x]**

Part/Assy No.:	Dwg No.:	Heat No.:	Pattern No.:
N/A	N/A	N/A	N/A

Scope: **UNIT 1 Turbine**

Ultrasonic Inspection to be carried out on Unit 1 Turbine Main Stop Valve Bolts.

Results:

An Ultrasonic Inspection was carried out as per scope in accordance with acceptance and procedure. At the time of inspection no defects were found. However 1 bolt was damaged by a torch on the top end and can't be fully inspected at this time. A measurement of 0.325" in depth was taken in the damaged area.

No defects were found on remaining bolts.

Total Parts Inspected	Total Parts Accepted	Total Parts Rejected
18	18	0

Scan: Longitudinal/ Zero Degree

Surface Finish: Smooth

ULTRASONIC EQUIPMENT				TRANSDUCER			
Make	Model	S/N	Cal. Date	Angle	Size	Frequency	S/N
Panametrics	Epoch LT	050059710	30 May 11	0 Deg	0.250	5.0 Mhz	F02207

Calibration Block: Step wedge 0.100-0.500"	**Serial No.:** 08-7638
Couplant: Exosen 30	**Batch No.:** 29110301

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TEAM TECHNICIAN: Print Name **Glenn Melindy** Signature	**Certification: 10096** ACCP Level II [ ] CGSB 48.9712 Level 2 [x] SNT-TC-1A Level II [ ]
CLIENT REPRESENTATIVE FINAL ACCEPTANCE: Print Name John Adams Signature	Date June 14/12

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623091	QA	-	2012-05-30	EN	Approved

INSPECTION & TEST PLAN

STATUS: MATERIAL TESTS | MANUFACTURING TESTS | STANDARD | X PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
10.00	Front Bearing Pedestal								
10.10	**Main Shaft Journal Bearing (HP)**								
10.11	Prior to Shutdown, record the: - Oil Supply Temperature - Bearing metal and oil drain temperatures - Vibration amplitudes	C	Field Service Spec. HTGD 672085	REPORT	A	A	A	HTGD 672085 is specified for OEM bearings after a retrofit. However, section 4 is applicable.	RS
10.12	Visually inspect: - Anti-rotation device for signs of wear and deformation - Support pads for signs of fretting - Babbitt metal for: - Scoring, pitting, or discoloration - Abnormal wear or loading patterns - Cracking, scratches, embedded foreign particles or signs of the babbitt lifting or separating from the backing material	C	Field Service Spec. HTGD 672085	REPORT	A	A	A	HTGD 672085 is specified for OEM bearings after a retrofit. However, section 4 is applicable.	RS
10.13	Non destructively test babbitt bond over the full babbitt surface, by ultrasonic tests (UT)	C	Field Service Spec. HZLM 621025 HTGD 672085	REPORT	A	AQ	AQ	HTGD 672085 is specified for OEM bearings after a retrofit. However, section 4 is applicable.	RS
10.14	Dimensionally inspect the horizontal and vertical bores at each end, with the two halves bolted Measure tilt and twist and bearing pinch	C	Field Service Spec. HTGD 672085	UTGS 623092	A	AQ	AQ	HTGD 672085 is specified for OEM bearings after a retrofit. However, section 4 is applicable.	RS
10.15	Check the oil supply for uninterrupted flow	C	Field Service Spec.	REPORT	A	A	A		RS
10.16	Check the thermocouples for the Babbitt metal temperatures Check the cable and plugs for damage	C	Field Service Spec.	REPORT	A	A	A		RS

The Inspection and Test Plan does not release the Supplier/Manufacturer from his obligation to take all steps necessary to ensure that the requirements stipulated in drawings and specifications are fulfilled for the product concerned.

Symbols/Abbreviations

1) Performed by
2) Acceptance by
3) Q-Records to
4) Internal Remarks

S = Supplier/Subcontractor
A = ALSTOM POWER Inc. or its Licensee/Contractor (non QC)
C = Customer or his representative

SQ = Supplier or customer's QC rep.
AQ = ALSTOM POWER INC. QC
YS = Acceptance by external authority

E = ALSTOM POWER INC. Design Engineering

ALSTOM POWER Inc. to Customer
H = Hold Point
M = Witness Point

Dept. Resp.: TSSI	Supersedes:		Superseded by:		
Prepared: See APC_RPDM	Date: See APC_RPDM	Title: General Electric D3 Turbine C Inspection + Valves			
Checked: See APC_RPDM	Date: See APC_RPDM	Unit Name: Holyrood Unit 1			
Approved: See APC_RPDM	Date: See APC_RPDM	WBZ:		Lang.: EN	
Derived From:		Outage: Summer 2012 Major Inspection		Sheets: 31	
ALSTOM POWER Inc.		Document No.: UTGS 623091	Rev. -	Sheet No.: 1	

Dept. 6105 | Document No. UTGS623091 | Type QA | Rev. - | Released 2012-05-30 | Lng. EN | Status Approved

INSPECTION & TEST PLAN

STATUS:	MATERIAL TESTS	MANUFACTURING TESTS	STANDARD	PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
10.20	**Thrust (Axial) Bearing**								
10.21	Prior to Shutdown, record the: - Oil Supply Temperature - Bearing metal and oil drain temperatures - Vibration amplitudes	C	Field Service Spec. HTGD 672014	REPORT	A	A	A	HTGD 672014 is specified for 2 collar thrust bearings. However, section 4 is applicable.	RS
10.22	Prior to Disassembly, record the rotor thrust/bump:	C	Field Service Spec.	UTGS 623093	A	AQ	AQ		RS
10.23	Visually inspect the thrust bearing components	C	Field Service Spec.	REPORT	A	A	A		RS
10.24	Visually inspect the thrust bearing segments for: - Running Surfaces: scratches, unevenness, contact pattern - Pad rear side: evidence of hammering, wear	C	Field Service Spec.	REPORT	A	A	A		RS
10.25	Measure thrust bearing components to determine actual clearance	C	Field Service Spec. HTGD 672014	UTGS 623093	A	AQ	AQ	HTGD 672014 is specified for 2 collar thrust bearings. However, section 4 is applicable.	RS
10.26	Non destructively test thrust bearing components by ultrasonic and dye penetrant tests (UT/PT)	C	Field Service Spec. HZLM 621025 HZLM 21013	REPORT	A	AQ	AQ		RS
10.27	Check the thermocouples for the metal temperatures Check the cable and plugs for damage	C	Field Service Spec.	REPORT	A	A	A	Plant I&C	RS
10.30	**HP Oil Deflector**								
10.31	Visual inspection of HP Oil Deflector	C	Field Service Spec.	REPORT	A	A	A		RS
10.32	Measure and record HP oil deflector ID & rotor OD Measure oil baffle clearances	C	Field Service Spec.	UTGS 623094	A	AQ	AQ		RS
10.33	Align the HP oil deflector to the rotor at reassembly	C	Field Service Spec.	UTGS 623094	A	AQ	AQ		RS
10.40	**Turbine Control Components**								
10.41	Visually inspect linkages and adjust as required	C	Field Service Spec.	REPORT	A	A	A		RS
10.42	Confirm operation of emergency governor	C	Field Service Spec.	REPORT	A	AQ	AQ		RS
10.43	Inspect and set oil trip nozzle	C	Field Service Spec.	REPORT	A	AQ	AQ		RS
10.44	Set and record gap on speed pickups	C	Field Service Spec.	REPORT	A	AQ	AQ	Plant I&C	RS
10.45	Inspect thrust bearing wear detector	C	Field Service Spec.	UTGS 623093	A	AQ	AQ	" "	RS

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INSPECTION & TEST PLAN

STATUS:	MATERIAL TESTS	MANUFACTURING TESTS	STANDARD	PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
10.50	**Turning Gear**								
10.51	Measure run-up time to turning gear operation Measure speed at turning gear operation, measure run-down time	A B C	Field Service Spec. HTGD 672046	REPORT	A	AQ	AQ	NOT Performed	RS
10.52	Check manual operation of turning gear	A B C	Field Service Spec. HTGD 672046	REPORT	A	A	A		RS
10.53	Dismantle and inspect visually the individual parts such as bearings, gears, gear wheel, bushings and coupling for wear and damages	C	Field Service Spec. HTGD 672046	UTGS 623095	A	AQ	AQ	NOT Performed VISUAL	RS
10.54	Measure backlash clearance and check contact patterns of gear wheels	C	Field Service Spec. HTGD 672046	REPORT	A	A	A		RS
10.60	**Front Standard / Pedestal**								
10.61	Measure pedestal key clearances Record front standard guide rail gap Visual inspection of guide keys sliding surface for scratches & wear	C	Field Service Spec.	UTGS 623096	A	AQ	AQ		RS
10.62	Visual inspection and surface crack test of all pedestal/bearing bolting and hardware (MT)	C	Field Service Spec. HZLM 21014 HZLM 603106	REPORT	A	AQ	AQ		RS
10.63	Check the cleanliness of the bearing pedestal before closing	C	Field Service Spec.	STAMP	A	A	A		RS
10.64	Check pre-stress of foundation bolts	C	Field Service Spec. HTGD 672030	STAMP	A	A	A	~~HTGD 672030, sections 3 & 4, are applicable.~~ N/A	
10.65	Check all pedestal joint bolts for correct pretension / torque	C	Field Service Spec. HTGD 630147	STAMP	A	A	A	HTGD 630147, section 5.1.1, is applicable.	RS
20.00	HP-LP Mid Standard / Pedestal with Journal Bearing								
20.10	**Mid Shaft Journal Bearing (HP-LP)**								
20.11	Prior to Shutdown, record the: - Oil Supply Temperature - Bearing metal and oil drain temperatures - Vibration amplitudes	C	Field Service Spec. HTGD 672085	REPORT	A	A	A	HTGD 672085 is specified for OEM bearings after a retrofit. However, section 4 is applicable.	RS

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INSPECTION & TEST PLAN

STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD	:	PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation

20.12	Visually inspect:
	- Anti-rotation device for signs of wear and deformation
	- Support pads for signs of fretting
	- Babbitt metal for:
	  - Scoring, pitting, or discoloration
	  - Abnormal wear or loading patterns
	  - Cracking, scratches, embedded foreign particles or signs of the babbitt lifting or separating from the backing material
		C	Field Service Spec. HTGD 672085	REPORT	A	A	A	HTGD 672085 is specified for OEM bearings after a retrofit. However, section 4 is applicable.	RE

20.13	Non destructively test babbitt bond over the full babbitt surface, by ultrasonic tests (UT)	C	Field Service Spec. HZLM 621025 HTGD 672085	REPORT	A	AQ	AQ	HTGD 672085 is specified for OEM bearings after a retrofit. However, section 4 is applicable.	RE
20.14	Dimensionally inspect the horizontal and vertical bores at each end, with the two halves bolted Measure tilt and twist and bearing pinch	C	Field Service Spec. HTGD 672085	UTGS 623092	A	AQ	AQ	HTGD 672085 is specified for OEM bearings after a retrofit. However, section 4 is applicable.	RE
20.15	Check the oil supply for uninterrupted flow	C	Field Service Spec.	REPORT	A	A	A		RE
20.16	Check the thermocouples for the Babbitt metal temperatures Check the cable and plugs for damage	C	Field Service Spec.	REPORT	A	A	A	Plant I&C	RE
20.20	**HP Inner Oil Deflector**								
20.21	Visual inspection of HP Inner Oil Deflector	C	Field Service Spec.	REPORT	A	AQ	AQ		RE
20.22	Measure and record HP Inner oil deflector ID & rotor OD Measure oil baffle clearances	C	Field Service Spec.	UTGS 623094	A	AQ	AQ		RE
20.23	Align the HP Inner oil deflector to the rotor at reassembly	C	Field Service Spec.	UTGS 623094	A	AQ	AQ		RE
20.30	**HP Outer Oil Deflector**								
20.31	Visual inspection of HP Outer Oil Deflector	C	Field Service Spec.	REPORT	A	AQ	AQ		RE
20.32	Measure and record HP Outer oil deflector ID & rotor OD Measure oil baffle clearances	C	Field Service Spec.	UTGS 623094	A	AQ	AQ		RE
20.33	Align the HP Outer oil deflector to the rotor at reassembly	C	Field Service Spec.	UTGS 623094	A	AQ	AQ		RE
20.40	**Bearing Pedestal**								
20.41	Measure pedestal key clearances Visual inspection of keys sliding surface for scratches & wear	C	Field Service Spec.	REPORT	A	AQ	AQ		RE

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Title: General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.: EN
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INSPECTION & TEST PLAN

STATUS:	MATERIAL TESTS	MANUFACTURING TESTS	STANDARD	PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
20.42	Visual inspection and surface crack test of all pedestal/bearing bolting and hardware (MT)	C	Field Service Spec. HZLM 21014 HZLM 603106	REPORT	A	AQ	AQ		RE
20.43	Check the cleanliness of the bearing pedestal before closing	C	Field Service Spec.	STAMP	A	A	A		RE
20.44	Check pre-stress of foundation bolts	C	Field Service Spec. HTGD 672030	STAMP	A	A	A	~~HTGD 672030, sections 3 & 4, are applicable.~~ N/A	RE
20.45	Check all pedestal joint bolts for correct pretension / torque	C	Field Service Spec. HTGD 630147	STAMP	A	A	A	HTGD 630147, section 5.1.1, is applicable.	RE
20.50	**HP-LP Coupling**								
20.51	Dimensional and surface inspection of coupling flanges and bolt holes	C	Field Service Spec. RSEF 200043	UTGD 410536	A	AQ	AQ	RSEF 200043, section 5.1.3.1, is applicable.	RE
20.52	Check coupling spigots for cleanliness, corrosion and damage	C	Field Service Spec. RSEF 200043	REPORT	A	A	A	RSEF 200043, section 5.1.3.1, is applicable.	RE
20.60	**HP-LP Coupling Bolts and Sleeves**								
20.61	Visually inspect the coupling bolts, check for damage & cracks Visually inspect the expansion sleeves (if applicable) & nuts for corrosion and deformation MT inspection check for cracks	C	Field Service Spec. UTGD 600274 HZLM 21014 HZLM 603106	REPORT	A	A	A		RE
20.62	Record all coupling bolt lengths in bolted condition	C	Field Service Spec.	REPORT	A	AQ	AQ		RE
20.63	Verify final assembly and tightness of all coupling bolts	C	Field Service Spec.	UTGS 623111	A	AQ	AQ		RE
30.00	LP Standard / Pedestal with Journal Bearing								
30.10	**Main Shaft Bearing (LP)**								
30.11	Prior to Shutdown, record the: - Oil Supply Temperature - Bearing metal and oil drain temperatures - Vibration amplitudes	C	Field Service Spec. HTGD 672085	REPORT	A	A	A	HTGD 672085 is specified for OEM bearings after a retrofit. However, section 4 is applicable.	RE

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Title:	General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.:	EN
Unit Name:	Holyrood Unit 1	Outage:	Summer 2012 Major Inspection	Sheets:	31
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INSPECTION & TEST PLAN

STATUS: | MATERIAL TESTS | MANUFACTURING TESTS | STANDARD | PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation

30.12	Visually inspect:
	- Anti-rotation device for signs of wear and deformation
	- Support pads for signs of fretting
	- Babbitt metal for:
	  - Scoring, pitting, or discoloration
	  - Abnormal wear or loading patterns
	  - Cracking, scratches, embedded foreign particles or signs of the babbitt lifting or separating from the backing material
		C	Field Service Spec.
			HTGD 672085
				REPORT	A	A	A	HTGD 672085 is specified for OEM bearings after a retrofit. However, section 4 is applicable.	RE

30.13	Non destructively test babbitt bond over the full babbitt surface, by ultrasonic tests (UT)	C	Field Service Spec. HZLM 621025 HTGD 672085	REPORT	A	AQ	AQ	HTGD 672085 is specified for OEM bearings after a retrofit. However, section 4 is applicable.	RE
30.14	Dimensionally inspect the horizontal and vertical bores at each end, with the two halves bolted Measure tilt and twist and bearing pinch	C	Field Service Spec. HTGD 672085	UTGS 623092	A	AQ	AQ	HTGD 672085 is specified for OEM bearings after a retrofit. However, section 4 is applicable.	RE
30.15	Check the oil supply for uninterrupted flow	C	Field Service Spec.	REPORT	A	A	A		RE
30.16	Check the thermocouples for the Babbitt metal temperatures Check the cable and plugs for damage	C	Field Service Spec.	REPORT	A	A	A	Phase I&C	RE
30.20	**LP Outer Turbine End Oil Deflector**								
30.21	Visual inspection of LP Outer Turbine End Oil Deflector	C	Field Service Spec.	REPORT	A	AQ	AQ		RE
30.22	Measure & record LP Outer Turbine End oil deflector ID & rotor OD Measure oil baffle clearances	C	Field Service Spec.	UTGS 623094	A	AQ	AQ		RE
30.23	Align the LP Outer Turbine End oil deflector to the rotor at reassembly	C	Field Service Spec.	UTGS 623094	A	AQ	AQ		RE
30.30	**LP Outer Generator End Oil Deflector**								
30.31	Visual inspection of LP Outer Generator End Oil Deflector	C	Field Service Spec.	REPORT	A	AQ	AQ		RE
30.32	Measure & record LP Outer Generator End oil defl. ID & rotor OD Measure oil baffle clearances	C	Field Service Spec.	UTGS 623094	A	AQ	AQ		RE
30.33	Align the LP Outer Generator End oil deflector to the rotor at reassembly	C	Field Service Spec.	UTGS 623094	A	AQ	AQ		RE

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INSPECTION & TEST PLAN

STATUS:	MATERIAL TESTS	MANUFACTURING TESTS	STANDARD	PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
30.40	**Bearing Pedestal**								
30.41	Measure pedestal key clearances Visual inspection of keys sliding surface for scratches & wear	C	Field Service Spec.	REPORT	A	AQ	AQ		RE
30.42	Visual inspection and surface crack test of all pedestal/bearing bolting and hardware (MT)	C	Field Service Spec. HZLM 21014 HZLM 603106	REPORT	A	AQ	AQ		RE
30.43	Check the cleanliness of the bearing pedestal before closing	C	Field Service Spec.	STAMP	A	A	A		
30.44	Check pre-stress of foundation bolts	C	Field Service Spec. HTGD 672030	STAMP	A	A	A	~~HTGD 672030, sections 3 & 4 are applicable.~~ N/A	RE
30.45	Check all pedestal joint bolts for correct pretension / torque	C	Field Service Spec. HTGD 630147	STAMP	A	A	A	HTGD 630147, section 5.1.1, is applicable.	RE
30.50	**LP - GEN Coupling**								
30.51	Dimensional and surface inspection of coupling flanges and bolt holes	C	Field Service Spec. RSEF 200043	UTGD 410536	A	AQ	AQ	RSEF 200043, section 5.1.3.1, is applicable.	NOT measured Visual RE
30.52	Check coupling spigots for cleanliness, corrosion and damage	C	Field Service Spec. RSEF 200043	REPORT	A	A	A	RSEF 200043, section 5.1.3.1, is applicable.	RE
30.60	**HP-LP Coupling Bolts and Sleeves**								
30.61	Visually inspect the coupling bolts, check for damage & cracks Visually inspect the expansion sleeves (if applicable) & nuts for corrosion and deformation MT inspection check for cracks	C	Field Service Spec. UTGD 600274 HZLM 21014 HZLM 603106	REPORT	A	A	A		RE
30.62	Record all coupling bolt lengths in bolted condition	C	Field Service Spec.	REPORT	A	AQ	AQ		RE
30.63	Verify final assembly and tightness of all coupling bolts	C	Field Service Spec.	UTGS 623111	A	AQ	AQ		RE

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STATUS:	MATERIAL TESTS	MANUFACTURING TESTS	STANDARD	PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
40.00	HP/IP Turbine								
40.10	**HP/IP Outer Cylinder**								
40.11	Check HP/IP Outer Cylinder horizontal joint flanges for damage, leakage and erosion	C	Field Service Spec. UTGD 600265	UTGS 623097	A	AQ	AQ	UTGD 600265, Table 1 visual inspections are applicable	
40.12	Check for galling, erosion, and mechanical damage in the bolt holes on the horizontal joint face	C	Field Service Spec. UTGD 600265	REPORT	A	A	A	UTGD 600265,Table 1 visual inspections are applicable	
40.13	Check casing surfaces for mechanical damage, foreign object damage, galling, erosion, corrosion, and rubbing from rotating parts NDT as required	C	Field Service Spec. HTGD 672012 HZLM 21014 HZLM 03405	REPORT	A	AQ	AQ	HTGD 672012, sections 4.1 and 4.2 are applicable.	
40.14	Check keyways for pressure marks and seizing, ensure good sliding Check support guides and fixing elements for damage/erosion	C	Field Service Spec. HTGD 672030	REPORT	A	A	A	HTGD 672030, section 4, is applicable.	
40.15	Measure inner to outer cylinder key clearance(s)	C	Field Service Spec.	UTGS 623098	A	AQ	AQ	N/A	
40.16	Measure clearance and pre-stress of fixed-point bolts	C	Field Service Spec. HTGD 630147	REPORT	A	AQ	AQ	HTGD 630147, section 5.1.1, is applicable.	
40.17	Check the pre-stress of the Inlet Pipe flange bolts, according to the OEM	C	Field Service Spec. HTGD 630147	STAMP	A	A	A	HTGD 630147, section 5.1.1, is applicable.	
40.18	Check the pre-stress of the HP/IP Outer Cylinder, according to the OEM	C	Field Service Spec. HTGD 630147	STAMP	A	A	A	HTGD 630147, section 5.1.1, is applicable.	
40.19	Verify all bolts for correct, final, pretension / torque	C	Field Service Spec. HTGD 630147	UTGS 623109	A	AQ	AQ	HTGD 630147, section 5.1.1, is applicable.	
40.20	Record condition of all turbine insulation	C	Field Service Spec.	STAMP	A	A	A		
40.30	**HP Inner Cylinder**								
40.31	Check the diaphragm carrier to outer casing reference measurements	C	Field Service Spec.	REPORT	A	AQ	AQ	Reference	
40.32	Check HP Inner Cylinder horizontal joint flanges for damage, leakage and erosion	C	Field Service Spec. UTGD 600265	UTGS 623097	A	AQ	AQ	UTGD 600265, Table 1 visual inspections are applicable	

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No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
40.33	Check for galling, erosion, and mechanical damage in the bolt holes on the horizontal joint face	C	Field Service Spec. UTGD 600265	REPORT	A	A	A	UTGD 600265, Table 1 visual inspections are applicable	RE
40.34	Visually inspect the HP Nozzle plate for foreign object damage and solid particle erosion	C	Field Service Spec. UTGD 600263	UTGS 623099	A	AQ	AQ	UTGD 600263, sections 4.1, 4.2, & 4.5, are applicable.	RE
40.35	Inspect and measure erosion at the nozzle – inner cylinder mating face	C	Field Service Spec.	UTGS 623100	A	AQ	AQ	N/A	RE
40.36	Dimensionally inspect the nozzle spill strip diameter	C	Field Service Spec.	UTGS 623115	A	AQ	AQ	N/A	RE
40.37	Check casing surfaces for mechanical damage, foreign object damage, galling, erosion, corrosion, and rubbing from rotating parts NDT as required	C	Field Service Spec. HTGD 672012 HZLM 21014 HZLM 03405	REPORT	A	AQ	AQ	HTGD 672012, sections 4.1 and 4.2 are applicable.	RE
40.38	Blue contact check HP Inner Cylinder horizontal joint	C	Field Service Spec. HTGD 620174	REPORT	A	AQ	AQ	~~HTGD 620174, sections 4.1.[illegible] are applicable.~~ N/A	RE
40.39	Measure the distortion in the inner casing	C	Field Service Spec. HTGD 672012	UTGS 621757	A	AQ	AQ	HTGD 672012, section 5.1, is applicable.	RE
40.40	Check keyways for pressure marks and seizing, ensure good sliding Check support guides and fixing elements for damage/erosion	C	Field Service Spec. HTGD 672030	REPORT	A	A	A	HTGD 672030, section 4, is applicable.	RE
40.41	Check mobility of piston rings	C	Field Service Spec.	STAMP	A	A	A		RE
40.42	Check the pre-stress of the HP Inner Cylinder, according to the OEM	C	Field Service Spec. HTGD 630147	STAMP	A	A	A	HTGD 630147, section 5.1.1, is applicable.	RE
40.43	Verify all bolts for correct, final, pretension / torque	C	Field Service Spec. HTGD 630147	STAMP	A	AQ	AQ	HTGD 630147, section 5.1.1, is applicable.	RE
40.50	**IP Diaphragm Carriers**								
40.51	Check the diaphragm carrier to outer casing reference measurements	C	Field Service Spec.	REPORT	A	AQ	AQ	Reference	RE
40.52	Check IP Diaphragm Carrier horizontal joint flanges for damage, leakage and erosion	C	Field Service Spec. UTGD 600265	UTGS 623097	A	AQ	AQ	UTGD 600265, Table 1 visual inspections are applicable	RE

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STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD		PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
40.53	Check for galling, erosion, and mechanical damage in the bolt holes on the horizontal joint faces	C	Field Service Spec. UTGD 600265	REPORT	A	A	A	UTGD 600265, Table 1 visual inspections are applicable	
40.54	Check casing surfaces for mechanical damage, foreign object damage, galling, erosion, corrosion, and rubbing from rotating parts NDT as required	C	Field Service Spec. UTGD 600265 HZLM 21014 HZLM 03405	REPORT	A	AQ	AQ	UTGD 600265, Table 1 visual inspections are applicable	
40.55	Measure diaphragm carrier to outer cylinder key clearance	C	Field Service Spec.	REPORT	A	AQ	AQ		
40.56	Check keyways for pressure marks and seizing, ensure good sliding Check support guides and fixing elements for damage/erosion	C	Field Service Spec. HTGD 672030	REPORT	A	A	A	HTGD 672030, section 4, is applicable.	
40.57	Verify all bolts for correct, final, pretension / torque	C	Field Service Spec. HTGD 630147	STAMP	A	AQ	AQ	HTGD 630147, section 5.1.1, is applicable.	
40.60	**HP/IP Diaphragms (Stages 2 – 17)**								
40.61	Check for damage, deposits and rubbing	C	Field Service Spec. UTGD 600269	REPORT	A	A	A		
40.62	Check horizontal joint flanges for damage, leakage and erosion	C	Field Service Spec. UTGD 600269	REPORT	A	A	A		
40.63	Check for galling, erosion, and mechanical damage in the bolt holes on the horizontal joint face	C	Field Service Spec. RSEF 2000013	REPORT	A	A	A	RSEF 200013, section 4.1.5.4 is applicable.	
40.64	MT of diaphragms Check structural welds for cracks	C	Field Service Spec. RSEF 2000013 HZLM 21014 HZLM 03405	REPORT	A	AQ	AQ	RSEF 200013, section 4.1.5.1 is applicable.	
40.65	Dimensional inspection of: - Axial crush pins, horizontal side slip, and vertical drop check - Diaphragm to casing axial clearance - Diaphragm key clearances	C	Field Service Spec.	UTGS 623101	A	AQ	AQ		

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Title: General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.: EN
Unit Name: Holyrood Unit 1	Outage: Summer 2012 Major Inspection		Sheets: 31
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STATUS:	MATERIAL TESTS	MANUFACTURING TESTS	STANDARD	PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
40.66	Dimensional inspection of: - All diaphragm tip seal diameters - Diaphragm partition throat check	C	Field Service Spec.	UTGS 623115 UTGS 623114	A	AQ	AQ	N/A	RE
40.67	Measure distortion of diaphragms	C	Field Service Spec.	UTGD 400946	A	AQ	AQ	N/A	RE
40.68	Measure and record diaphragm clearances	C	Field Service Spec.	UTGS 623116	A	AQ	AQ		RE
40.69	Verify all bolts for correct, final, pretension / torque	C	Field Service Spec. HTGD 630147	STAMP	A	AQ	AQ	HTGD 630147, section 5.1.1, is applicable.	RE
40.70	**Gland Casings**								
40.71	Check for damage, deposits and rubbing	C	Field Service Spec. UTGD 600269	REPORT	A	A	A	Presuming that gland casings have similar properties to diaphragms	RE
40.72	Check horizontal joint flanges for damage, leakage and erosion	C	Field Service Spec. UTGD 600269	REPORT	A	A	A	Presuming that gland casings have similar properties to diaphragms	RE
40.73	Check for galling, erosion, and mechanical damage in the bolt holes on the horizontal joint face	C	Field Service Spec. RSEF 2000013	REPORT	A	A	A	RSEF 200013, section 4.1.5.4 is applicable.	RE
40.74	MT of gland casings Check structural welds for cracks	C	Field Service Spec. RSEF 2000013 HZLM 21014 HZLM 03405	REPORT	A	AQ	AQ	RSEF 200013, section 4.1.5.1 is applicable.	RE
40.75	Measure distortion of gland casings	C	Field Service Spec.	UTGD 400946	A	AQ	AQ		RE
40.76	Verify all bolts for correct, final, pretension / torque	C	Field Service Spec. HTGD 630147	STAMP	A	AQ	AQ	HTGD 630147, section 5.1.1, is applicable.	RE
40.80	**Gland Seal Segments**								
40.81	Dimensionally inspect all diaphragm and gland casing seal segment axial and radial clearances, at disassembly and reassembly	C	Field Service Spec. HTGD 672025	UTGS 623103	A	AQ	AQ	HTGD 672025, section 4.1, is applicable.	RE
40.82	Dimensionally inspect all diaphragm and gland casing seal segment butt clearances	C	Field Service Spec. HTGD 672025	UTGS 623104	A	AQ	AQ	~~HTGD 672025, section 4.1, is applicable.~~ N/A	RE

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Title: General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.: EN
Unit Name: Holyrood Unit 1	Outage: Summer 2012 Major Inspection		Sheets: 31
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INSPECTION & TEST PLAN

STATUS: MATERIAL TESTS | MANUFACTURING TESTS | STANDARD | PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
40.83	Check seal segments for damage, freedom of movement and security	C	Field Service Spec. HTGD 672025	REPORT	A	A	A	HTGD 672025, section 4.1, is applicable.	PE
40.84	Check springs are in good condition	C	Field Service Spec. HTGD 672025	REPORT	A	AQ	AQ	HTGD 672025, section 4.1, is applicable.	PE
40.85	Visually inspect for bent, broken and rolled over teeth Visually inspect for rubbing from rotating components MT as required	C	Field Service Spec. HTGD 672025 HZLM 21014 HZLM 03405	UTGS 623102	A	AQ	AQ	HTGD 672025, section 4.1, is applicable.	PE
40.90	**Joint Studs, Nuts, and Other Hardware**								
40.91	Visually inspect for damage and erosion, after sandblast	C	Field Service Spec. RSEF 200012	REPORT	A	AQ	AQ	RSEF 200012, section 4.1.3, is applicable.	PE
40.92	NDT (MT) all horizontal joint bolts, nuts, sleeves/washers	C	Field Service Spec. RSEF 200012 HZLM 21014 HZLM 03405	REPORT	A	AQ	AQ	RSEF 200012, section 4.1.4, is applicable	PE
40.93	Measure the length of the studs	C	Field Service Spec.	REPORT	A	AQ	AQ	N/A	PE
41.00	**Instrumentation**								
41.01	Inspect for broken attachment hardware, cut wires and tubes, broken components	C	Field Service Spec. UTGD 600265	REPORT	A	A	A	Plant I&C	PE
41.10	**Inlet and Extraction pipes**								
41.11	Inspect for mechanical damage, galling, erosion, and corrosion on the seal and fit surfaces. Impressions or chipping on seal surfaces	C	Field Service Spec. UTGD 600265	REPORT	A	A	A		PE
41.20	**HP/IP Steam & Drain Pipes**								
41.21	Inspect the drains for unobstructed flow, damage, and scaling; NDE as required	C	Field Service Spec. HTGD 672038	REPORT	A	A	A		PE

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Title:	General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.:	EN
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STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD				PROJECT
No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation	
50.00	HP/IP Turbine Rotor									
50.10	**HP/IP Rotor**									
50.11	Prior to rotor removal: Measure - Rotor centerline position readings - Axial displacement of the rotor to casing - Rotating to stationary gap clearance checks at all seal locations - Measure the position of the rotor with respect to the pedestals	C	Field Service Spec.	UTGS 623110	A	AQ	AQ	Reference	RE	
50.12	Dimensional inspection of: - All rotor blade tip seal diameters - All rotor interstage packing seal diameters - All rotor gland seal packing seal diameters	C	Field Service Spec. RSEC 200001	REPORT	A	AQ	AQ	RSEC 200001, Table 4, is applicable	RE	
50.13	Dimensional inspection of rotor wheel clearances	C	Field Service Spec. RSEC 200001	UTGS 623105	A	AQ	AQ	RSEC 200001, Table 4, is applicable	RE	
50.14	Visual opening inspection of removed rotor	C	Field Service Spec.	UTGS 623106	A	A	A	Photographs should be put in the repor t of any damage noted at disassembly	RE	
50.15	Perform incoming 8-point runout inspection with a two steady setup	C	Field Service Spec. RSEF 200002	REPORT	A	AQ	AQ	RSEF 200002, section 4.1.6, is applicable	N/A RE	
50.16	Check for damage, erosion, corrosion and rubbing; after sandblast	C	Field Service Spec. RSEF 200002	REPORT	A	A	A	RSEF 200002, section 4.1.3, is applicable See notes 4.2.1-4.2.5	RE	
50.17	Perform MT of rotor; after sandblast	C	Field Service Spec. RSEF 200002 PS 181/0220	REPORT	A	AQ	AQ	RSEF 200002, section 4.1.7, is applicable PS 181/0220 states "applicable to ALSTOM Power Service UK activities" however, sections 1-2 & 4-9 still apply for Holyrood.	RE	
50.20	**Rotating Blades**									
50.21	Check for damage, erosion, deposits, and rubbing	C	Field Service Spec. RSEF 200002	REPORT	A	A	A	RSEF 200002, sections 4.1.4.2 - 4.1.4.9, are applicable See notes 4.2.1-4.2.5	RE	

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Title: General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.: EN
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STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD		PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
50.22	Check the security of blades and blade pins (if applicable)	C	Field Service Spec. UTGD 600263	REPORT	A	AQ	AQ		[illegible]
50.23	Visual inspection of blades; after sandblast	C	Field Service Spec. UTGD 600090 UTGD 600263	REPORT	A	A	A		[illegible]
50.24	Perform NDT of complete blading assemblies; after sandblast MT for ferritic, PT for austenitic	C	Field Service Spec. RSEF 200002 PS 181/0220 PS 181/0006	REPORT	A	AQ	AQ	RSEF 200002, section 4.1.8, is applicable PS 181/0220 & PS 181/0006 state "applicable to ALSTOM Power Service UK activities" however, sections 1-2 & 4-9, for MT, and sections 2-9 for PT, still apply for Holyrood.	[illegible]
50.30	**Journal Areas**								
50.31	Check for damage and surface finish Measure for size, taper, and ovality	C	Field Service Spec. RSEF 200002	UTGS 623108	A	AQ	AQ	RSEF 200002, section 4.1.3.1, is applicable	[illegible]
50.32	Dimensional and surface inspection of thrust collar, journals and oil seal landings	C	Field Service Spec. RSEF 200002	UTGD 410537	A	AQ	AQ	RSEF 200002, sections 4.1.3.1 & 4.1.3.2, are applicable	[illegible]
50.40	**Balance Weights**								
50.41	Check security	C	Field Service Spec. RSEF 200002	REPORT	A	A	A	RSEF 200002, section 4.1.3.7, is applicable	[illegible]
50.42	Record distribution of weights	C	Field Service Spec. RSEF 200002	UTGS 623107	A	AQ	AQ	~~RSEF 200002, section 4.1.3.7, is applicable~~ N/A	[illegible]

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No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
60.00	LP Turbine								
60.10	**LP Outer Cylinder**								
60.11	Check horizontal joint flange for damage, leakage and erosion	C	Field Service Spec. UTGD 600265	REPORT	A	AQ	AQ	UTGD 600265, Table 1, visual inspections are applicable	
60.12	Check for galling, erosion, and mechanical damage in the bolt holes on the horizontal joint face	C	Field Service Spec. UTGD 600265	REPORT	A	A	A	UTGD 600265,Table 1, visual inspections are applicable	
60.13	Check casing surfaces for mechanical damage, foreign object damage, galling, erosion, corrosion, and rubbing from rotating parts NDT as required	C	Field Service Spec. UTGD 600265 HZLM 21014 HZLM 03405	REPORT	A	AQ	AQ	UTGD 600265, Table 1,visual inspections are applicable	
60.14	Check keyways for pressure marks and seizing, ensure good sliding Check support guides and fixing elements for damage/erosion	C	Field Service Spec. HTGD 672030	REPORT	A	A	A	HTGD672030, section 4, is applicable.	
60.15	Record inner to outer cylinder key clearance(s)	C	Field Service Spec.	REPORT	A	AQ	AQ		
60.16	Measure clearance and pre-stress of fixed-point bolts	C	Field Service Spec. HTGD 630147	REPORT	A	AQ	AQ	HTGD 630147, section 5.1.1, is applicable.	
60.17	Check the pre-stress of the LP crossover pipe bolts, according to the OEM	C	Field Service Spec. HTGD 630147	STAMP	A	A	A	HTGD 630147, section 5.1.1, is applicable.	
60.18	Check the pre-stress of the LP Outer Casing, according to the OEM		Field Service Spec. HTGD 630147	STAMP	A	A	A	HTGD 630147, section 5.1.1, is applicable.	
60.19	Verify all bolts for correct, final, pretension / torque	C	Field Service Spec. HTGD 630147	STAMP	A	AQ	AQ	HTGD 630147, section 5.1.1, is applicable.	
60.20	Check LP Exahust spray cooling nozzles for erosion and blockage	C	Field Service Spec. HTGD 672082	STAMP	A	A	A	HTGD 672082, section 4.10, is applicable.	
60.21	Record condition of all turbine insulation	C	Field Service Spec.	STAMP	A	A	A		

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Title:	General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.:	EN
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No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
60.30	**LP Inner Casing**								
60.31	Check horizontal joint flange for damage, leakage and erosion	C	Field Service Spec. UTGD 600265	REPORT	A	A	A	UTGD 600265, Table 1 visual inspections are applicable	RC
60.32	Check for galling, erosion, and mechanical damage in the bolt holes on the horizontal joint face	C	Field Service Spec. UTGD 600265	REPORT	A	A	A	UTGD 600265,Table 1 visual inspections are applicable	RC
60.33	Check casing surfaces for mechanical damage, foreign object damage, galling, erosion, corrosion, and rubbing from rotating parts NDT as required	C	Field Service Spec. HTGD 672012 HZLM 21014 HZLM 03405	REPORT	A	AQ	AQ	HTGD 672012, sections 4.1 and 4.2 are applicable.	RC
60.34	Check keyways for pressure marks and seizing, ensure good sliding Check support guides and fixing elements for damage/erosion	C	Field Service Spec. HTGD 672030	REPORT	A	A	A	HTGD 672030, section 4, is applicable.	RC
60.35	Check the pre-stress of the LP Inner Casing, according to the OEM	C	Field Service Spec. HTGD 630147	STAMP	A	A	A	HTGD 630147, section 5.1.1, is applicable.	RC
60.36	Verify all bolts for correct, final, pretension / torque	C	Field Service Spec. HTGD 630147	STAMP	A	AQ	AQ	HTGD 630147, section 5.1.1, is applicable.	RC
60.40	**LP Diaphragms**								
60.41	Check for damage, deposits and rubbing	C	Field Service Spec. UTGD 600269	REPORT	A	A	A		RC
60.42	Check horizontal joint flanges for damage, leakage and erosion	C	Field Service Spec. UTGD 600269	REPORT	A	A	A		RC
60.43	Check for galling, erosion, and mechanical damage in the bolt holes on the horizontal joint face	C	Field Service Spec. RSEF 2000013	REPORT	A	A	A	RSEF 200013, section 4.1.5.4 is applicable.	RC
60.44	MT of diaphragms Check structural welds for cracks	C	Field Service Spec. RSEF200013 HZLM 21014 HZLM 03405	REPORT	A	AQ	AQ	RSEF 200013, section 4.1.5.1 is applicable.	RC

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Title: General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.: EN
Unit Name: Holyrood Unit 1	Outage: Summer 2012 Major Inspection		Sheets: 31
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No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
60.45	Dimensional inspection of: - Axial crush pins, horizontal side slip, and vertical drop check - Diaphragm to casing axial clearance - Diaphragm key clearances	C	Field Service Spec.	UTGS 623101	A	AQ	AQ		
60.46	Dimensional inspection of: - All diaphragm tip seal diameters - Diaphragm partition throat check	C	Field Service Spec.	UTGS 623115 UTGS 623114	A	AQ	AQ	N/A	
60.47	Measure distortion of diaphragms	C	Field Service Spec.	UTGD 400946	A	AQ	AQ	N/A	
60.48	Measure and record diaphragm clearances	C	Field Service Spec.	UTGS 623116	A	AQ	AQ		
60.49	Verify all bolts for correct, final, pretension / torque	C	Field Service Spec. HTGD 630147	STAMP	A	AQ	AQ	HTGD 630147, section 5.1.1, is applicable.	
60.50	**Gland Casings**								
60.51	Check for damage, deposits and rubbing	C	Field Service Spec. UTGD 600269	REPORT	A	A	A	Presuming that gland casings have similar properties to diaphragms	
60.52	Check horizontal joint flanges for damage, leakage and erosion	C	Field Service Spec. UTGD 600269	REPORT	A	A	A	Presuming that gland casings have similar properties to diaphragms	
60.53	Check for galling, erosion, and mechanical damage in the bolt holes on the horizontal joint face	C	Field Service Spec. RSEF 2000013	REPORT	A	A	A	RSEF 200013, section 4.1.5.4 is applicable.	
60.54	MT of gland casings Check structural welds for cracks	C	Field Service Spec. RSEF 2000013 HZLM 21014 HZLM 03405	REPORT	A	AQ	AQ	RSEF 200013, section 4.1.5.1 is applicable.	
60.55	Measure distortion of gland casings	C	Field Service Spec.	UTGD 400946	A	AQ	AQ		
60.56	Verify all bolts for correct, final, pretension / torque	C	Field Service Spec. HTGD 630147	STAMP	A	AQ	AQ	HTGD 630147, section 5.1.1, is applicable.	
60.60	**Gland Seal Segments**								
60.61	Dimensionally inspect all diaphragm and gland casing seal segment axial and radial clearances, at disassembly and reassembly	C	Field Service Spec. HTGD 672025	UTGS 623103	A	AQ	AQ	HTGD 672025, section 4.1, is applicable.	

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No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
60.62	Dimensionally inspect all diaphragm and gland casing seal segment butt clearances	C	Field Service Spec. HTGD 672025	UTGS 623104	A	AQ	AQ	~~HTGD 672025, section 4.1, is applicable.~~ N/A	
60.63	Check seal segments for damage, freedom of movement and security	C	Field Service Spec. HTGD 672025	REPORT	A	A	A	HTGD 672025, section 4.1, is applicable.	
60.64	Check springs are in good condition	C	Field Service Spec. HTGD 672025	REPORT	A	AQ	AQ	HTGD 672025, section 4.1, is applicable.	
60.65	Visually inspect for bent, broken and rolled over teeth Visually inspect for rubbing from rotating components MT as required	C	Field Service Spec. HTGD 672025 HZLM 21014 HZLM 03405	UTGS 623102	A	AQ	AQ	HTGD 672025, section 4.1, is applicable.	
60.70	**Joint Studs, Nuts, and Other Hardware**								
60.71	Visually inspect for damage and erosion, after sandblast	C	Field Service Spec. RSEF 200012	REPORT	A	AQ	AQ	RSEF 200012, section 4.1.3, is applicable.	
60.72	NDT (MT) all horizontal joint bolts, nuts, sleeves/washers	C	Field Service Spec. RSEF 200012 HZLM 21014 HZLM 03405	REPORT	A	AQ	AQ	RSEF 200012, section 4.1.4, is applicable	
60.73	Measure the length of the studs	C	Field Service Spec.	REPORT	A	AQ	AQ	N/A	
60.80	**Instrumentation**								
60.81	Inspect for broken attachment hardware, cut wires and tubes, broken components	C	Field Service Spec. UTGD 600265	REPORT	A	A	A	Plant I&C	
60.90	**Inlet and extraction pipes**								
60.91	Inspect for mechanical damage, galling, erosion, and corrosion on the seal and fit surfaces. Impressions or chipping on seal surfaces	C	Field Service Spec. UTGD 600265	REPORT	A	A	A		
61.00	**LP Steam & Drain Pipes**	C	HTGD 672038						
61.01	Inspect the drains for unobstructed flow, damage, and scaling; NDE as required	C	Field Service Spec. HTGD 672040	REPORT	A	A	A		

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INSPECTION & TEST PLAN

STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD		PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
70.00	LP Turbine Rotor								
70.10	**LP Rotor**								
70.11	Prior to rotor removal: Measure - Rotor centerline position readings - Axial displacement of the rotor to casing - Rotating to stationary gap clearance checks at all seal locations - Measure the position of the rotor with respect to the pedestals	C	Field Service Spec.	UTGS 623110	A	AQ	AQ	Reference	
70.12	Dimensional inspection of: - All rotor blade tip seal diameters - All rotor interstage packing seal diameters - All rotor gland seal packing seal diameters	C	Field Service Spec. RSEC 200001	REPORT	A	AQ	AQ	RSEC 200001, Table 4, is applicable	
70.13	Dimensional inspection of rotor wheel clearances	C	Field Service Spec. RSEC 200001	UTGS 623105	A	AQ	AQ	RSEC 200001, Table 4, is applicable	
70.14	Visual opening inspection of removed rotor	C	Field Service Spec.	UTGS 623106	A	A	A	Photographs should be put in the repor t of any damage noted at disassembly	
70.15	Perform incoming 8-point runout inspection with a two steady setup	C	Field Service Spec. RSEF 200003	REPORT	A	AQ	AQ	RSEF 200003, section 4.1.7 is applicable	
70.16	Check for damage, erosion, corrosion and rubbing; after sandblast	C	Field Service Spec. RSEF 200003	REPORT	A	A	A	RSEF 200003, section 4.1.3, is applicable See notes 4.2.1-4.2.5	
70.17	Perform MT of rotor; after sandblast	C	Field Service Spec. RSEF 200002 PS 181/0220	REPORT	A	AQ	AQ	RSEF 200003, section 4.1.8, is applicable PS 181/0220 states "applicable to ALSTOM Power Service UK activities" however, sections 1-2 & 4-9 still apply for Holyrood.	

Symbols/Abbreviations

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Title:	General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.:	EN
Unit Name:	Holyrood Unit 1	Outage:	Summer 2012 Major Inspection	Sheets:	31
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STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD	:	PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
70.20	**Rotating Blades (except L-1 & L-0)**								
70.21	Check for damage, erosion, deposits, and rubbing	C	Field Service Spec. RSEF 200003	REPORT	A	A	A	RSEF 200003, sections 4.1.4.2 - 4.1.4.8, are applicable See notes 4.2.1-4.2.5	
70.22	Check the security of blades and blade pins (if applicable)	C	Field Service Spec. RSEF 200003	REPORT	A	AQ	AQ	RSEF 200003, section 4.1.5, is applicable	
70.23	Visual inspection of rotor and blades; after sandblast	C	Field Service Spec. UTGD 600090 UTGD 600263	REPORT	A	A	A		
70.24	Perform NDT of complete blading assemblies; after sandblast MT for ferritic, PT for austenitic	C	Field Service Spec. RSEF 200003 PS 181/0220 PS 181/0006	REPORT	A	AQ	AQ	RSEF 200003, section 4.1.9, is applicable PS 181/0220 & PS 181/0006 state "applicable to ALSTOM Power Service UK activities" however, sections 1-2 & 4-9, for MT, and sections 2-9 for PT, still apply for Holyrood.	
70.30	**Rotating Blades L-1 & L-0**								
70.31	Check for damage, erosion, deposits and rubbing	C	Field Service Spec. RSEF 200003	REPORT	A	A	A	RSEF 200003, sections 4.1.4.2 - 4.1.4.8, are applicable See notes 4.2.1-4.2.5	
70.32	Check the security of blades and blade pins (if applicable) or axial locking pieces (if applicable)	C	Field Service Spec. RSEF 200003	REPORT	A	AQ	AQ	RSEF 200003, section 4.1.5, is applicable	
70.33	Check for tip rock and snubber wear (if applicable)	C	Field Service Spec. RSEF 200003	REPORT	A	AQ	AQ	RSEF 200003, section 4.1.5.1, is applicable	
70.34	Visual inspection of cleaned rotor and blades; after sandblast	C	Field Service Spec. UTGD 600090 UTGD 600263	REPORT	A	A	A		

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Title:	General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.:	EN
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No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
70.35	Perform NDT of complete blading assemblies; after sandblast MT for ferritic, PT for austenitic	C	Field Service Spec. RSEF 200003 PS 181/0220 PS 181/0006	REPORT	A	AQ	AQ	RSEF 200003, section 4.1.9, is applicable PS 181/0220 & PS 181/0006 state "applicable to ALSTOM Power Service UK activities" however, sections 1-2 & 4-9, for MT, and sections 2-9 for PT, still apply for Holyrood.	RE
70.40	**Journal Areas**								
70.41	Check for damage and surface finish Measure for size, taper, and ovality	C	Field Service Spec. RSEF 200003	UTGS 623108	A	AQ	AQ	RSEF 200003, section 4.1.3.1, is applicable	RE
70.42	Dimensional and surface inspection of journals and oil seal landings		Field Service Spec. RSEF 200003	UTGD 410537	A	AQ	AQ	RSEF 200003, section 4.1.3.1, is applicable	R
70.50	**Balance Weights**								
70.51	Check security	C	Field Service Spec. RSEF 200003	REPORT	A	A	A	RSEF 200003, section 4.1.3.6, is applicable	RE
70.52	Record distribution of weights	C	Field Service Spec. RSEF 200003	UTGS 623107	A	AQ	AQ	RSEF 200003, section 4.1.3.6, is applicable	N/A RE
80.00	Alignment								
80.10	**Coupling Alignment**								
80.11	Record coupling alignment gap and centerline error by measuring the parallelism / offset, at disassembly and reassembly: - Perform rotor coupling bolted inspections - Separate coulpings and perform coupling unbolted inspection At disassembly and reassembly	C	Field Service Spec. HTGD 672045	UTGS 623112	A	AQ	AQ		RE
80.12	Check all bearing alignment/references to rotor shafts prior to disassembly	C	Field Service Spec.	UTGS 623110	A	AQ	AQ		RE

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INSPECTION & TEST PLAN

STATUS: MATERIAL TESTS | MANUFACTURING TESTS | STANDARD | PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
80.20	**Shaft Alignment**								
80.21	Align all internal components to ensure proper clearance specifications between stationary and rotating components	C	Field Service Spec.	REPORT	A	AQ	AQ		RE
90.00	Lube/Hydraulic Oil Supply System								
90.01	Clean and inspect main lube oil tank/reservoir - Inspect walls for chipped paint, piping, and flanges for loose bolts - Inspect piping for leaks and cracks in fabrication welds	C	Field Service Spec.	REPORT	A	AQ	AQ		RE
90.02	Inspect & clean main oil pump Record internal conditions and clearances	C	Field Service Spec.	UTGS 623113	A	AQ	AQ	N/A	RE
90.03	Inspect & clean auxillary lube oil pumps Record internal conditions and clearances	C	Field Service Spec.	UTGS 623112	A	AQ	AQ	2-A/C 1-DC	RE
90.04	Clean and inspect main lube oil coolers (tube sheets and tubes) - Inspect tube sheets - Inspect tubes	C	Field Service Spec.	REPORT	A	AQ	AQ		RE
100.00	Main Stop Valve								
100.10	**Disassembly**								
100.11	Measure and record the 'as found' gap between the cover and valve body, prior to unbolting	C	Drawing 2129102	UTGS622593	A	A	A, C		[signature]
100.12	Measure and record the 'as found' valve stroke and bypass valve lift (for the 3 bypass valves)	C	Drawing 2129102	UTGS622592	A	A	A, C	OIL TAGGED OUT	
100.20	**Maintenance & Inspection**								
100.21	Measure and record the valve stem outer diameters and bushing bore inner diameters	C	Drawing 2129102	UTGS622591	A	A	A, C	Before and after cleaning	[signature]
100.22	Measure and record the valve stem runout	C	Drawing 2129102	UTGS622591	A	A	A, C		[signature]
100.23	Confirm bushing alignment by passing the try bar through the pressure seal head	C	O&M Manual	STAMP	A	A	A, C		[signature]

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No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
100.24	Blue contact check the valve stem backseat to the backseat bushing in the pressure seal head	C	O&M Manual	PHOTOGRAPH	A	A	A, C	360° contact 1.6 mm wide	[signature]
100.25	Visually inspect the valve casing gasket area, valve disc, valve seat, and 3 bypass valve seating areas; NDE further as needed	C	HTGD 620179	REPORT	A	A, E	A, C		[signature]
100.26	Visually and NDE inspect all bolting, as required	C	HTGD 620179	REPORT	A	A, E	A, C		[signature]
100.27	Visually inspect & liquid penetrant test the valve stem, pressure seal head, and the steam strainers at screen welds and rivet welds	C	HTGD 620179 HZLM 21013 HZLM 603106	REPORT	A	A, E	A, C		[signature]
100.28	Visually inspect & magnetic particle test the valve casing body / interior	C	HTGD 620179 HZLM 21014 HZLM 603106	REPORT	A	A, E	A, C		[signature]
100.29	Liquid penetrant test the valve disc stellite inlay, valve seat stellite, seat weld areas, and lower pressure seal head land	C	HZLM 21013 HZLM 25000	REPORT	A	A, E	A, C		[signature]
100.30	Blue contact check the valve disc to seat	C	O&M Manual	PHOTOGRAPH	A	A	A, C	360° contact 1.6 mm wide	[signature]
100.31	Blue contact check the bypass valve disc to seat, for the 3 bypass valves	C	O&M Manual	PHOTOGRAPH	A	A	A,C	360° contact 1.6 mm wide	[signature]
100.32	Visually inspect the coupling elements for damage, deformation and corrosion	C	HTGD 620179	REPORT	A	A, E	A,C	CLEANED	[signature]
100.33	Inspect the drains for unobstructed flow, damage, and scaling; NDE as required	C	HTGD 620179	REPORT	A	A, E	A,C		[signature]
100.40	**Reassembly**								
100.41	Confirm all bolts are torqued as required	C	O&M Manual	REPORT	A	A	A,C		[signature]
100.42	Measure and record the 'as left' valve stroke and bypass valve lift (for the 3 bypass valves)	C	Drawing 2129102	UTGS622592	A	A	A,C		[signature]
100.43	Measure and record the 'as left' gap between the cover and valve body, after bolting	C	Drawing 2129102	UTGS622593	A	A	A,C		[signature]

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Title:	General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.:	EN
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INSPECTION & TEST PLAN

STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD		PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
110.00	Control Valves – instructions are for each of the 3 upper valves & 3 lower valves								
110.10	**Disassembly**								
110.11	Hydraulically stroke the valves and measure and record 'as found' intercept points	C	Drawing 2129109 & 2129705	UTGS622597	A	A	A,C	OIL TAGGED OUT	
110.12	Confirm that the upper control valve pointer is in line with the "A" mark on the pinion	C	Drawing 2129109	STAMP	A	A	A,C	Hydraulic piston fully closed	[signature]
110.13	When the upper control valve pointer is in line with the "B" mark on the upper control valve pinion, confirm that the "C" mark on the lower control valve pinion is lined up with the lower control valve pointer	C	Drawing 2129109 & 2129705	STAMP	A	A	A,C		[signature]
110.14	Measure and record the 'as found' clearances between the cam & the cam roller and between the shim & lever arm	C	Drawing 2129109 & 2129705	UTGS622597	A	A	A,C	NOT DONE	
110.15	Matchmark and identify the 'as found' teeth engagement between rack and cam shaft	C	Drawing 2129109 & 2129705	STAMP	A	A	A,C	With valve closed	[signature]
110.16	Matchmark and identify the 'as found' linkage alignment marks	C	Drawing 2129109 & 2129705	STAMP	A	A	A,C		[signature]
110.17	Measure and record the crosshead runout, while installed in the valve	C	Drawing 2129109 & 2129705	UTGS622595	A	A	A,C		[signature]
110.20	**Maintenance & Inspection**								
110.21	Measure and record the valve stem outer diameters and bushing bore inner diameters	C	Drawing 2129109 & 2129705	UTGS622595	A	A	A,C	Before and after cleaning	[signature]
110.22	Measure and record the valve stem runouts	C	Drawing 2129109 & 2129705	UTGS622595	A	A	A,C		[signature]
110.23	Measure and record the valve disc pin fit inner diameter and the valve disc pin outer diameter	C	Drawing 2129109 & 2129705	UTGS622595	A	A	A,C	2+5 NEW	
110.24	Confirm bushing alignment by passing the try bar through	C	O&M Manual	STAMP	A	A	A,C		[signature]
110.25	Measure and record crosshead guide outer diameters and crosshead guide bushing inner diameters	C	Drawing 2129109 & 2129705	UTGS622595	A	A	A,C		[signature]
110.26	Blue contact check the stem-to-crosshead	C	O&M Manual	PHOTOGRAPH	A	A	A,C	360° contact	[signature]
110.27	Measure and record the camshaft bearing inner diameters and journal outer diameters	C	Drawing 2129109 & 2129705	UTGS622596	A	A	A,C		[signature]

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No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
110.28	Measure and record the cam roller bearing inner diameters and pin outer diameters	C	Drawing 2129109 & 2129705	UTGS622596	A	A	A,C		
110.29	Measure and record the lever arm bearing inner diameters and pin outer diameters	C	Drawing 2129109 & 2129705	UTGS622596	A	A	A,C		
110.30	Visually inspect & liquid penetrant test the valve stem and the rack & pinion gear	C	HTGD 620179 HZLM 21013 HZLM 603106	REPORT	A	A, E	A,C		
110.31	Visually inspect & magnetic particle test the valve casing body / interior	C	HTGD 620179 HZLM 21014 HZLM 603106	REPORT	A	A, E	A,C	VISUAL ONLY NOT DONE	MT
110.32	Visually inspect the valve casing gasket area, spring, valve disc, and valve seat; NDE further as needed	C	HTGD 620179	REPORT	A	A, E	A,C		
110.33	Liquid penetrant test the seat weld areas	C	HZLM 21013 HZLM 25000	REPORT	A	A, E	A,C		
110.34	Visually and NDE inspect all bolting, as required	C	HTGD 620179	REPORT	A	A, E	A,C	NDE	
110.35	Blue contact check the disc to seat	C	O&M Manual	PHOTOGRAPH	A	A	A,C	360° contact 1.6 mm wide	
110.40	**Reassembly**								
110.41	Record the stem to crosshead torque	C	O&M Manual	UTGS622595	A	A	A,C	Design is 407 Nm	
110.42	Confirm all bolts are torqued as required	C	O&M Manual	REPORT	A	A	A,C		
110.43	Confirm the lever arm pin and cam rollers have freedom of movement	C	Drawing 2129109 & 2129705	STAMP	A	A	A,C		
110.44	Confirm the shaft has freedom of movement	C	Drawing 2129109 & 2129705	STAMP	A	A	A,C		
110.45	Measure and record the 'as left' clearance between the cam & the cam roller and between the shim & lever arm	C	Drawing 2129109 & 2129705	UTGS622597	A	A	A,C		
110.46	Measure and record the connecting rod overtravel	C	Drawing 2129109 & 2129705	UTGS622597	A	A	A,C	NOT DONE	

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No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
110.47	Hydraulically stroke the valves and measure and record 'as left' intercept points	C	Drawing 2129109 & 2129705	UTGS622597	A	A	A,C	NA	
110.48	Confirm that the upper control valve pointer is in line with the "A" mark on the pinion	C	Drawing 2129109	STAMP	A	A	A,C	Hydraulic piston fully closed	
110.49	When the upper control valve pointer is in line with the "B" mark on the upper control valve pinion, confirm that the "C" mark on the lower control valve pinion is lined up with the lower control valve pointer	C	Drawing 2129109 & 2129705	STAMP	A	A	A,C		
110.50	Measure and record the travel of the hydraulic piston to the crack point of #1 valve	C	Drawing 2129109	UTGS622597	A	A	A,C	NA	
110.51	Inspect the drains for unobstructed flow, damage, and scaling; NDE as required	C	HTGD 620179	REPORT	A	A, E	A,C		
120.00	Combined Reheat / Intercept Valves - instructions are for each of the two combined valves								
120.10	**Disassembly**								
120.11	Measure and record the 'as found' gap between the cover and valve body, prior to unbolting	C	Drawing 2129104	UTGS622605	A	A	A,C		
120.12	Measure and record the 'as found' intercept valve stroke & bypass valve lift; and the 'as found' reheat stop valve stroke	C	Drawing 2129104	UTGS622604	A	A	A,C	NOT DONE	
120.20	**Maintenance & Inspection**								
120.21	Measure and record the following outer diameters: Intercept valve stem, IV crosshead, IV seal rings, and the reheat stop valve stem	C	Drawing 2129104	UTGS622603	A	A	A,C	Before and after cleaning	
120.22	Measure and record the following inner diameters: Intercept valve bushing bores, IV crosshead guide bushing, IV valve guide, and the reheat stop valve bushing bores	C	Drawing 2129104	UTGS622603	A	A	A,C	Before and after cleaning	
120.23	Visually inspect & liquid penetrant test the valve stems	C	HTGD 620179 HZLM 21013 HZLM 603106	REPORT	A	A, E	A,C		

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120.24	Measure and record the intercept valve and reheat stop valve stem runouts	C	Drawing 2129104	UTGS622603	A	A	A,C		
120.25	Confirm bushing alignment by passing the try bars through the bushings	C	O&M Manual	STAMP	A	A	A,C		
120.26	Blue contact check the valve stem backseats to the backseat bushings	C	O&M Manual	PHOTOGRAPH	A	A	A,C	360° contact 1.6 mm wide	
120.27	Visually inspect the valve casing gasket area, valve discs, valve seats, and bypass valve seating area; NDE further as needed	C	HTGD 620179	REPORT	A	A, E	A,C		
120.28	Visually and NDE inspect all bolting, as required	C	HTGD 620179	REPORT	A	A, E	A,C		
120.29	Visually inspect & magnetic particle test the valve casing body's / interiors	C	HTGD 620179 HZLM 21014 HZLM 603106	REPORT	A	A, E	A,C		
120.30	Liquid penetrant test the valve disc stellite inlay, valve seat stellite, seat weld areas, lower bushing land, and steam strainer at screen welds and rivet welds	C	HZLM 21013 HZLM 25000	REPORT	A	A, E	A,C		
120.31	Blue contact check the valve discs to seats	C	O&M Manual	PHOTOGRAPH	A	A	A,C	360° contact 1.6 mm wide	
120.32	Blue contact check the bypass valve disc to seat	C	O&M Manual	PHOTOGRAPH	A	A	A,C	360° contact 1.6 mm wide	
120.33	Visually inspect the coupling elements for damage, deformation and corrosion	C	HTGD 620179	REPORT	A	A, E	A,C		
120.34	Inspect the drains for unobstructed flow, damage, and scaling; NDE as required	C	HTGD 620179	REPORT	A	A, E	A,C		
120.40	**Reassembly**								
120.41	Confirm all bolts are torqued as required	C	O&M Manual	REPORT	A	A	A,C		
120.42	Measure and record the 'as left' intercept valve stroke & bypass valve lift; and the 'as left' reheat stop valve stroke	C	Drawing 2129104	UTGS622604	A	A	A,C		
120.43	Measure and record the 'as left' gap between the cover and valve body, after bolting	C	Drawing 2129104	UTGS622605	A	A	A,C		

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Title: General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.: EN
Unit Name: Holyrood Unit 1	Outage: Summer 2012 Major Inspection		Sheets: 31
ALSTOM POWER Inc.	Document No.: UTGS 623091	Rev. -	Sheet No.: 27

Dept. 6105 | Document No. UTGS623091 | Type QA | Rev. - | Released 2012-05-30 | Lng. EN | Status Approved

INSPECTION & TEST PLAN

STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD	:	PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
130.00	Blowdown Valve								
130.10	**Disassembly**								
130.11	Measure and record the 'as found' valve stroke and bypass valve lift	C	Drawing 2124472	UTGS622601	A	A	A,C	NOT DONE	
130.12	Measure the 'as found' gap between the piston rod and stem	C	Drawing 2124472	UTGS622600	A	A	A,C		
120.13	Measure the 'as found' clearance between the seal rings and the valve cap	C	Drawing 2124472	UTGS622600	A	A	A,C		
130.20	**Maintenance & Inspection**								
130.21	Measure and record the valve stem & piston rod outer diameters and the bushing bore inner diameters	C	Drawing 2124472	UTGS622600	A	A	A,C		
130.22	Measure and record the piston ring outer diameters and the cylinder & bushing inside diameters	C	Drawing 2124472	UTGS622600	A	A	A,C		
130.23	Measure and record the valve stem and piston rod runouts	C	Drawing 2124472	UTGS622600	A	A	A,C		
130.24	Visually inspect & liquid penetrant test the valve stem, disc, and seat	C	HTGD 620179 HZLM 21013 HZLM 603106	REPORT	A	A, E	A,C		
130.25	Visually inspect the valve casing interior, valve head, piston rod, piston rings, lever arm, spring, piston gasket, and air cylinder; NDE further as needed	C	HTGD 620179	REPORT	A	A, E	A,C		
130.26	Visually and NDE inspect all bolting, as required	C	HTGD 620179	REPORT	A	A, E	A,C		
130.27	Blue contact check the valve disc to seat	C	O&M Manual	PHOTOGRAPH	A	A	A,C	360° contact 1.6 mm wide	
130.28	Test, with water, the contact between the bypass valve disc and seat	C	FSR 20351378-2008	STAMP	A	A	A,C		
130.29	Inspect the drains for unobstructed flow, damage, and scaling; NDE as required	C	HTGD 620179	REPORT	A	A, E	A,C		
130.30	**Reassembly**								
130.31	Confirm all bolts are torqued as required	C	O&M Manual	REPORT	A	A	A,C		
130.32	Measure and record the 'as left' valve stroke and bypass valve lift	C	Drawing 2124472	UTGS622601	A	A	A,C		
130.33	Measure the 'as left' gap between the piston rod and stem	C	Drawing 2124472	UTGS622600	A	A	A,C		

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Title: General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.: EN
Unit Name: Holyrood Unit 1	Outage: Summer 2012 Major Inspection		Sheets: 31
ALSTOM POWER Inc.	Document No.: UTGS 623091	Rev. -	Sheet No.: 28

INSPECTION & TEST PLAN

STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD		PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
130.34	Measure the 'as left' clearance between the seal rings and the valve cap	C	Drawing 2124472	UTGS622600	A	A	A,C		
140.00	Non-Return Valve & Actuator - instructions are for each of the eight valves								
140.10	**Disassembly**								
140.11	Matchmark the 'as found' actuator jam nut position, relative to the end of the piston rod	C	Atwood & Morrill Procedure	STAMP	A	A	A,C		
140.12	Matchmark the 'as found' actuator valve cylinder cap position	C	Atwood & Morrill Procedure	STAMP	A	A	A,C		
140.20	**Maintenance & Inspection**								
140.21	Measure and record the valve shaft & actuator piston rod outer diameters and the bushing bore & actuator cylinder inner diameters	C	Drawing 5154-F	UTGS622602	A	A	A,C		
140.22	Visually inspect the actuator cylinder, piston rod, and spring; NDE further as needed	C	HTGD 620179	REPORT	A	A, E	A,C		
140.23	Visually inspect the valve body, disc arm, weighted lever, linkage, lever connection, glands, keys, and packing; NDE further as needed	C	HTGD 620179	REPORT	A	A, E	A,C		
140.24	Visually inspect & liquid penetrant test the valve disc and body seat	C	HTGD 620179 HZLM 21013 HZLM 603106	REPORT	A	A, E	A,C		
140.25	Visually inspect & magnetic particle test the valve shaft	C	HTGD 620179 HZLM 21014 HZLM 603106	REPORT	A	A, E	A,C		
140.26	Blue contact check the valve disc to body seat	C	O&M Manual	PHOTOGRAPH	A	A	A,C	360° contact	
140.30	**Reassembly**								
140.31	Confirm that the 'as left' actuator valve cylinder cap is positioned at the matchmark made during disassembly	C	Atwood & Morrill Procedure	STAMP	A	A	A,C		
140.32	Confirm that the 'as left' actuator valve jam nut is positioned at the matchmark made during disassembly	C	Atwood & Morrill Procedure	STAMP	A	A	A,C		

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Title: General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.: EN
Unit Name: Holyrood Unit 1	Outage: Summer 2012 Major Inspection		Sheets: 31
ALSTOM POWER Inc.	Document No.: UTGS 623091	Rev. -	Sheet No.: 29

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623091	QA	-	2012-05-30	EN	Approved

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623091	QA	-	2012-05-30	EN	Approved

INSPECTION & TEST PLAN

STATUS:	MATERIAL TESTS	MANUFACTURING TESTS	STANDARD	PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	Q Activities 2)	Q Activities 3)	Remarks 4)	Q Record No. or Confirmation
140.33	Confirm all bolts are torqued as required	C	O&M Manual	REPORT	A	A	A,C		
150.00	Deairator Non-Return Valve								
150.10	**Disassembly**								
150.11	Matchmark the 'as found' actuator jam nut position, relative to the end of the piston rod	C	Atwood & Morrill Procedure	STAMP	A	A	A,C		
150.12	Matchmark the 'as found' actuator valve cylinder cap position	C	Atwood & Morrill Procedure	STAMP	A	A	A,C		
150.20	**Maintenance & Inspection**								
150.21	Measure and record the valve shaft & actuator piston rod outer diameters and the bushing bore & actuator cylinder inner diameters	C	Drawing 5154-F	UTGS622602	A	A	A,C		
150.22	Visually inspect the actuator cylinder, piston rod, and spring; NDE further as needed	C	HTGD 620179	REPORT	A	A, E	A,C		
150.23	Visually inspect the valve body, disc arm, weighted lever, linkage, lever connection, glands, keys, and packing; NDE further as needed	C	HTGD 620179	REPORT	A	A, E	A,C		
150.24	Visually inspect & liquid penetrant test the valve disc and body seat	C	HTGD 620179 HZLM 21013 HZLM 603106	REPORT	A	A, E	A,C		
150.25	Visually inspect & magnetic particle test the valve shaft	C	HTGD 620179 HZLM 21014 HZLM 603106	REPORT	A	A, E	A,C		
150.26	Blue contact check the valve disc to body seat	C	O&M Manual	PHOTOGRAPH	A	A	A,C		
150.30	**Reassembly**								
150.31	Confirm that the 'as left' actuator valve cylinder cap is positioned at the matchmark made during disassembly	C	Atwood & Morrill Procedure	STAMP	A	A	A,C		
150.32	Confirm that the 'as left' actuator valve jam nut is positioned at the matchmark made during disassembly	C	Atwood & Morrill Procedure	STAMP	A	A	A,C		
150.33	Confirm all bolts are torqued as required	C	O&M Manual	REPORT	A	A	A,C		

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Title:	General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.:	EN
Unit Name:	Holyrood Unit 1	Outage:	Summer 2012 Major Inspection	Sheets:	31
ALSTOM POWER Inc.		Document No.: UTGS 623091	Rev. -	Sheet No.:	30

INSPECTION & TEST PLAN

STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD		PROJECT

No.	Description	Inspection Type	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
160.00	I&T Plan Close Out								
	Verification of quality records for completeness								RC
	Print Name: Robert M Scott								
	Company: ALSTOM Power								
	Date/Signature: R Scott	A B C		SIGN OFF	A	AQ	AQ		

Dept.	Document No.	Type	Rev.	Released	Lng.	Status
6105	UTGS623091	QA	-	2012-05-30	EN	Approved

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Title: General Electric D3 Turbine C Inspection + Valves	WBZ:		Lang.:	EN
Unit Name: Holyrood Unit 1	Outage: Summer 2012 Major Inspection		Sheets:	31
ALSTOM POWER Inc.	Document No.: UTGS 623091	Rev. -	Sheet No.:	31

STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD	X	PROJECT

No.	Description	Applicable Procedure/Drawing	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
1.0000	**Prior to Shutdown**							
1.0010	Record monitored operating data		UTGE600264	C	A	AQ, E, C		N/A [signature]
2.0000	**During LP Turbine-Generator Coupling Disassembly**							
2.0010	As-found coupling runouts		UTGE621881	A	A	AQ, E, C	N/M	[signature] 5-25-2012
2.0020	As-found coupling alignment check	SEE TURBINE REPORT	UTGE621882	A	A	AQ, E, C	After coupling bolt removal	[signature] 5-28-2012
3.0000	**Rotor Supported in Bearings, UH Endshields Removed**							
3.0010	Measure as-found NDE generator rotor clearances and air gap		UTGE622038 UTGE622036	A	A	AQ, E, C		[signature] 5-30-12
3.0020	Measure as-found DE generator rotor clearances and air gap		UTGE622037 UTGE622036	A	A	AQ, E, C		[signature] 6-1-12
4.0000	**After Disassembly of NDE and DE Components**							
4.0010	Visual inspection of NDE outer oil deflector		UTGE621887	A	A	AQ,	TURBINE REPORT	[signature] 6-15-2012

The Inspection and Test Plan does not release the Supplier/Manufacturer from his obligation to take all steps necessary to ensure that the requirements stipulated in drawings and specifications are fulfilled for the product concerned.

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Prepared: J.Jensen	Date: 05/25/2012	Approved: J. Fiaux	Date: 05/25/2012

ALSTOM POWER Inc.	Title: Newfoundland & Labrador Hydro, Holyrood #1 Generator Major Inspection I&T Plan	Lang.: EN
		Rev.: A
		Sheets: 8
	Document No.: UTGE 622040	Sheet No.: 1

STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD	X	PROJECT

No.	Description	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
						E, C		
4.0020	Measure as-found NDE outer oil deflector diameter		UTGE621887	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-15-2012
4.0030	Visual inspection of NDE inner oil deflector		UTGE621887	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-18-2012
4.0040	Measure as-found NDE inner oil deflector diameter		UTGE621887	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-18-2012
4.0050	Visual inspection of NDE bearing	HTGD672085	UTGE621885	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-9-2012
4.0060	Measure as-found NDE bearing diameter		UTGE621885	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-16-2012
4.0070	UT inspection of NDE bearing babbit	HZLM621025	Report	A	A	AQ, E, C	NDT babbit bond over full surface	[signature] 6-15-12
4.0080	Measure as-found NDE H2 seal ring diameter		UTGE622045	A	A	AQ, E, C		[signature] 6-11-2012
4.0090	Visual inspection of DE outer oil deflector		UTGE621887	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-15-12
4.0100	Measure as-found DE outer oil deflector diameter		UTGE621887	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-15-12
4.0110	Visual inspection of DE inner oil deflector		UTGE621887	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-18-2012

ALSTOM POWER Inc.	Title: Newfoundland & Labrador Hydro, Holyrood #1 Generator Major Inspection I&T Plan	Lang.: EN
		Rev.: A
		Sheets: 8
	Document No.: UTGE 622040	Sheet No.: 2

STATUS:		MATERIAL TESTS		MANUFACTURING TESTS			STANDARD		X	PROJECT
No.	Description			Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
4.0120	Measure as-found DE inner oil deflector diameter				UTGE621887	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-18-2012
4.0130	Visual inspection of DE bearing			HTGD672085	UTGE621885	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-9-2012
4.0140	Measure as-found DE bearing diameter				UTGE621885	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-18-2012
4.0150	UT inspection of DE bearing babbit			HZLM621025	Report	A	A	AQ, E, C	NDT babbit bond over full surface	[signature] 6-15-2012
4.0160	Measure as-found DE H2 seal ring diameter				UTGE622045	A	A	AQ, E, C		[signature] 6-20-2012
5.0000	**After Removal of Rotor**									
5.0010	Complete visual inspection of rotor				HTAE667024	A	A	AQ, E, C	Couplings, journals, seal areas, retaining rings, body OD, wedges, slip rings, etc.	[signature] 6-15-2012
5.0020	Measure NDE outer oil deflector journal				HTCM445380	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-18-2012
5.0030	Measure NDE inner oil deflector journal				HTCM445380	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-18-2012
5.0040	Measure DE outer oil deflector journal				HTCM445380	A	A	AQ,	TURBINE REPORT	[signature] 6-18-2012

ALSTOM POWER Inc.	Title: Newfoundland & Labrador Hydro, Holyrood #1 Generator Major Inspection I&T Plan	Lang.: EN
		Rev.: A
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STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD		X	PROJECT
No.	Description	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)		Q Record No. or Confirmation
						E, C			
5.0050	Measure DE inner oil deflector journal		HTCM445380	A	A	AQ, E, C	TURBINE REPORT		6-18-2012
5.0060	Measure NDE bearing journal		HTCM445380	A	A	AQ, E, C	TURBINE REPORT		6-15-2012
5.0070	Measure DE bearing journal		HTCM445380	A	A	AQ, E, C	TURBINE REPORT		6-15-2012
5.0090	Measure NDE H2 seal journal		HTCM445380	A	A	AQ, E, C	DATASHEET UTGE 622045		6-11-2012
5.0100	Measure DE H2 seal journal		HTCM445380	A	A	AQ, E, C	DATA SHEET UTGE 622045		6-11-2012
5.0110	Winding resistance test	HTCM629470	HTCZ656969	A	A	AQ, E, C	SEE REPORT FROM KLAUS MORAWEK		6-14-2012
5.0120	Impedance test & pole balance	HTZW 23344 IEEE56-1997, Sect. 8.2.4		A	A	AQ, E, C	10A or 100VAC REPORT FROM KLAUS MORAWEK		6-14-2012
5.0130	Insulation resistance & PI REPORT FROM KLAUS MORAWEK	HTAE60012	HTAE667003	A	A	AQ, E, C	500V, 1 min. & 10 min.		6-14-2012
6.0000	**Generator Stator Inspection**								

ALSTOM POWER Inc.	Title: Newfoundland & Labrador Hydro, Holyrood #1 Generator Major Inspection I&T Plan	Lang.: EN
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STATUS:		MATERIAL TESTS		MANUFACTURING TESTS			STANDARD		X	PROJECT

No.	Description	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
6.0010	Complete visual inspection of the stator windings, phase rings, endwinding support system, stator core & instrumentation REPORT FROM KLAUS MORAWEK		HTCZ656934 HTCZ656939	A	A	AQ, E, C	Loose blocks or ties, dusting, greasing, corona, etc.	[signature] 6-16-2012
6.0020	Stator winding insulation resistance test & PI REPORT FROM KLAUS MORAWEK	HTAE60012	HTAE667002	A	A	AQ, E, C	Per phase @ 5kV, 1 min. & 10 min.	[signature] 6-16-2012
6.0030	Megger RTD's REPORT FROM KLAUS MORAWEK – N/A		HTAE667035	A	A	AQ, E, C	500VDC for 1 min.	N/A
6.0040	EL-CID test REPORT FROM KLAUS MORAWEK	Adwel EL-CID Operating Handbook, V4.06		A	A	AQ, E, C	REPORT FROM KLAUS MORAWEK	[signature] 6-16-2012
6.0050	Stator slot wedge tightness REPORT FROM KLAUS MORAWEK	HTAE660140	HTAE667023	A	A	AQ, E, C	REPORT FROM KLAUS MORAWEK	[signature] 6-15-2012
6.0060	Bump testing of stator endwinding REPORT FROM SHAREM ELMI	UTGE602042	Report	A	A	AQ, E, C	SHAHRAM ELMI REPORT	[signature] 6-11-2012
7.0000	**Brushgear Inspection**							
7.0010	Complete visual inspection of brushgear CUSTOMER SCOPE		Report	A	A	AQ, E, C		N/A CUSTOMER SCOPE
8.0000	**Prior to Reassembly of NDE and DE Components**							
8.0010	Measure final NDE outer oil deflector diameter		UTGE621887	A	A	AQ, E, C	TURBINE REPORT	[signature] 6-15-2012

ALSTOM POWER Inc.	Title: Newfoundland & Labrador Hydro, Holyrood #1 Generator Major Inspection I&T Plan	Lang.: EN
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STATUS:		MATERIAL TESTS		MANUFACTURING TESTS			STANDARD		X	PROJECT
No.	Description			Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
8.0020	Measure final NDE inner oil deflector diameter				UTGE621887	A	A	AQ, E, C	TURBINE REPORT	6-15-2012
8.0030	Measure final NDE bearing diameter				UTGE621885	A	A	AQ, E, C	TURBINE REPORT	6-16-2012
8.0040	Measure final NDE H2 seal ring diameter				UTGE622045	A	A	AQ, E, C		6-18-2012
8.0050	Measure final DE outer oil deflector diameter				UTGE621887	A	A	AQ, E, C	TURBINE REPORT	6-18-2012
8.0060	Measure final DE inner oil deflector diameter				UTGE621887	A	A	AQ, E, C	TURBINE REPORT	6-18-2012
8.0070	Measure final DE bearing diameter				UTGE621885	A	A	AQ, E, C	TURBINE REPORT	6-16-2012
8.0080	Measure final DE H2 seal ring diameter				UTGE622045	A	A	AQ, E, C		6-18-2012
9.0000	**Rotor Supported in Bearings, UH Endshields Removed**									
9.0010	Measure final NDE generator rotor clearances and air gap				UTGE622038 UTGE622036	A	A	AQ, E, C		7-3-2012
9.0020	Measure final DE generator rotor clearances and air gap				UTGE622037 UTGE622036	A	A	AQ, E, C		7-3-2012
10.0000	**During Reassembly of NDE and DE Components**									

ALSTOM POWER Inc.	Title: Newfoundland & Labrador Hydro, Holyrood #1 Generator Major Inspection I&T Plan	Lang.: EN
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STATUS:		MATERIAL TESTS		MANUFACTURING TESTS		STANDARD	X	PROJECT

No.	Description	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)	Q Record No. or Confirmation
10.0010	Measure final NDE inner oil deflector alignment		UTGE622039	A	A	AQ, E, C		8-6-12
10.0020	Measure final NDE outer oil deflector alignment		UTGE622039	A	A	AQ, E, C	TURBINE REPORT	7-7-2012
10.0030	Perform NDE bearing ball contact check, pinch check, twist & tilt check		UTGE621885	A	A	AQ, E, C	Turbine Report	8-6-12
10.0040	Measure final DE inner oil deflector alignment		UTGE622039	A	A	AQ, E, C	Turbine Report	8-6-12
10.0050	Measure final DE outer oil deflector alignment		UTGE622039	A	A	AQ, E, C	Turbine Report	8-6-12
10.0060	Perform DE bearing ball contact check, pinch check, twist & tilt check		UTGE621885	A	A	AQ, E, C	TURBINE Report	8-6-12
10.0070	Megger NDE H2 seal housing – end shield joint		UTGE622044	A	A	AQ, E, C	500VDC for 1 min.	8-6-12
10.0080	Measure NDE H2 seal clearances		UTGE622044	A	A	AQ, E, C		8-6-12
10.0080	Measure DE H2 seal clearances		UTGE622044	A	A	AQ, E, C		8-6-12
11.0000	**During LP Turbine-Generator Coupling Disassembly**							
11.0010	Final coupling runouts		UTGE621881	A	A	AQ, E, C	Turbine Report	8-6-12

ALSTOM POWER Inc.	Title: Newfoundland & Labrador Hydro, Holyrood #1 Generator Major Inspection I&T Plan	Lang.: EN
		Rev.: A
		Sheets: 8
	Document No.: UTGE 622040	Sheet No.: 7

STATUS:		MATERIAL TESTS		MANUFACTURING TESTS			STANDARD	X	PROJECT
No.	Description	Applicable Procedure	Applicable Standard or Type of Q Record	Q Activities 1)	2)	3)	Remarks 4)		Q Record No. or Confirmation
11.0020	Final coupling alignment check		UTGE621882	A	A	AQ, E, C	Turbine Report		RE 8-6-12
11.0030	Coupling bolt stretch		UTGE621883	A	A	AQ, E, C	Turbine Report		RE 8-6-12

ALSTOM POWER Inc.	Title: Newfoundland & Labrador Hydro, Holyrood #1 Generator Major Inspection I&T Plan	Lang.: EN
		Rev.: A
		Sheets: 8
	Document No.: UTGE 622040	Sheet No.: 8

ALSTOM

Customer Field Service Report (CFSR)

Customer Field Service Report (CFSR)	Related FSR issued ☒ Y ☐ N		Total pages without enclosures	Total pages enclosures
Report No. **CFRG015595**			8	15
Location US	Department PAC Americas	Author Klaus Morawek	Date 02.07.2012	Page No. 0

Site Information

Customer Newfoundland And Labrador Hydro	File Name CFRG015595_Diagnostics_120702_Morawek.pdf	
Site **HOLYROOD**	Country Name CANADA	PDM Event No.
Plant **HOLYROOD 1**	Plant Type FO	Outage code
Unit **HOLYROOD 1**	Service Ref No.	Order No. IT0-000017
System / Machine Generator	System / Machine Type ATB 2 Pole 60 Cycles	System / Machine Serial No. 980485

Task Information

Business Case
Overhaul / C-Inspection

Task
Diagnostics

Task description

Generator Diagnostics

Author handed over Draft CFSR to customer ☐ Yes ☒ No

Distribution of CFSR

Authors Distribution List				Official Distribution List			
Loc.	Dept.	Name	Notes	Loc.	Dept.	Name	Notes
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US	Thermal Services	Reviewed by Nathalie Muelhaupt	Date 05.07.2012
US	PAC Americas	Approved by Richard D Gupton	Date 05.07.2012
US	Thermal Services	Archived by Bianca K Figueroa	Date 05.07.2012

Customer Field Service Report

Task	**WIDIPRO III**
Unit	HOLYROOD 1
System	Generator
Date	02.07.2012
Report No.	**CFRG015595**
Author	Klaus Morawek
Reviewed by	Nathalie Muelhaupt
Approved by	Richard D Gupton

CFSR received by Customer

Name	Department	Date	Signature

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TABLE OF CONTENT

1. Summary

The generator was opened for an overhaul inspection. The generator (stator, rotor) and in particular the stator winding, were thoroughly inspected. The inspection was carried out on the stator and rotor winding within the scope of general machine service to the ALSTOM - WIDIPRO® II program.

The results of the electrical tests showed both the stator and rotor winding insulation to be in normal and reliable condition. The measurements and the visual inspection showed following results in detail:

- Stator and rotor just a little bit dirty by dry dust;
- Small signs of corona marks between the phases in the stator end winding area;
- Few cracks and current marks in the core step area between the core and the bars, indicating little movement - but no damage to the insulation;
- Normal slot wedging condition.

The required maintenance work was started immediately. The work performed should allow the generator to run without problems for the next operating period.

2. Purpose and duration of assignment

Purpose of assignment	Arrival Date	Departure Date
WIDIPRO® II Generator Inspection on Unit 1	12.06.2012	17.06.2012

3. Milestones

Unit	HOLYROOD 1		
No.	Milestone	Planned Date	Actual Date
1	Visual inspection	13.06.2012	13.06.2012
2	Electrical Test Rotor	14.06.2012	14.06.2012
3	ElCid Test	15.06.2012	15.06.2012
4	Electrical Test Stator	16.06.2012	16.06.2012

4. Personnel involved

Unit		HOLYROOD 1					
No.	Name	Department	Code	Function	Position	Arrival Date	Departure Date
1	Klaus (Mo) Morawek	PAC	CGD	Commissioning Generator Diagnostics	Specialist	12.06.2012	17.06.2012

5. Operation data

Nothing to report

6. Technical information

Unit		HOLYROOD 1		
Type of data		Technical Information Generator		
No.	Description	Unit	Reading / Value	Remarks
1	Type	-	ATB2 Poles 60 Cycles	
2	Generator / Stator Serial No.	-	980485	
3	Manufacturer (OEM) / Supplier	-	GE	
4	Rotor Serial No.	-		
5	Rated Speed	rpm	3600	
6	Rated Frequency	Hz	60	
7	Rated Apparent Power	kVA	194	
8	Rated Power Factor	-	0.90	
9	Rated Stator Voltage	kV	16.00	
10	Rated Stator Current	A	7016	
11	Rated Field Voltage	kV_{DC}	0.375	
12	Rated Field Current	A_{DC}	1864	
13	Insulation system	(stator wind.)		
14	Insulation class	(stator wind.)		
15	Cooling System (medium)	(rotor/stator)		
16	Excitation System	-		
17	Exciter Type	-		
18	Exciter Fabrication No.	-		

7. Work carried out

7.1. Overview

Generator diagnosis according WIDIPRO II.

All required actions: see maintenance Working Order >> Enclosure M

7.2. Stator

7.2.1. Visual inspection

7.2.1.1. Cleanliness

The stator was just a little bit dirty from dry dust.

7.2.1.2. Overhang supports

All fixing parts were in good condition.

7.2.1.3. Phase rings and leads

All phase rings and terminal leads were in faultless and reliable condition. There was some minor greasing.

7.2.1.4. Generator terminals

The generator terminals (insulation, corona protection) were in normal condition.

7.2.1.5. Overhang insulation

The overhang insulation was found to be in faultless and reliable condition.

7.2.1.6. Corona protection

Small corona marks were found between phases in the end winding area on DE and NDE, both, at the back and the front side.

7.2.1.7. Surface condition

All parts are in normal condition. In the slot exit area, local small cracks in the paint (small movements / expansion marks) were found.

7.2.1.8. Coil end-insulation / Insulating caps

All insulating caps were in order. There was minor cracking but no signs of overheating.

7.2.1.9. Stator core

The stator core was in order.

7.2.1.10. Boroscope inspection

With the boroscope, small gaps between the stator bar and the slot wall were detected. These are expected and no damage to the insulation could be found.

7.2.1.11. Flexible connections inside and outside of the generator

All flexible connections were dismantled and thoroughly inspected. There were no deficiencies.

7.2.1.12. Generator housing

The generator housing was just a little dirty by dust.

7.2.2. Slot wedging test

The stator slot wedging was tested mechanically using the tapping test.

Test results >> Enclosure A

7.2.3. Check of RTDs

All RTDs, except one in the stator winding, as well as the RTDs for warm / cold air temperatures (measurement direct in the generator terminal box) were found to be in faultless and reliable condition.

Action required => yes *See maintenance working order*

7.2.4. Charging current measurement

The charging current was measured as a function of time with a constant DC voltage from 5000 V_{DC} between each phase of the stator winding and the core. The measured values and the characteristic values calculated therefrom are in normal condition. The test results showed that the insulation surface is in a faultless and dry condition.

Test results >> Enclosure B

7.2.5. EL CID (Electromagnetic Core Imperfection Detection) Low flux test

The EL CID low flux test of the core, as well of the step iron area on the NDE and DE, showed no abnormality. The enclosed graphic representation of the stator low flux test was carefully analyzed and the results reported in enclosure C. ALSTOM will retain the recorded data, enabling a trend analysis to be conducted in addition to an assessment of the current condition.

Test results >> Enclosure C

7.2.6. Stator DLRO testing (Digital low resistance ohmmeter).

An impedance test on the stator windings was performed by connecting the test leads of the DLRO to both ends of the phase bars. This test equipment supplies a current up to 10 A through the windings in order to provide a measurement for the resistance of the windings.

Test results >> Enclosure D

7.3. Rotor

7.3.1. Visual inspection (End bells not removed)

7.3.1.1. Cleanliness

7.3.1.2. Surface conditions

The surface was found in a good condition.

7.3.1.3. End winding insulation

Normal condition.

7.3.1.4. End winding fixing

Nothing inadmissible was found on the end winding fixing.

7.3.1.5. Air chamber guides

Nothing inadmissible was found on the air chamber guides.

7.3.1.6. Indication of current marks

No signs of current marks (inspection only on the damping coil - rotor wedge) were found.

7.3.1.7. Retaining rings

No indications or signs of anything inadmissible were discovered on the rotor retaining rings (end bells).

7.3.2. Charging current measurement

The charging current was measured as a function of time with a constant DC voltage of 500 V_{DC} between the whole rotor winding and the rotor shaft. The obtained current gives no indication of insulation weaknesses.

Test results >> Enclosure E

7.3.3. Insulation resistance measurement

The insulation resistance was within the range for a dry and faultless rotor winding insulation.

Test results >> Enclosure E

7.3.4. Rotor DLRO testing (Digital low resistance ohmmeter)

An impedance test on the rotor windings was performed by connecting the test leads of the DLRO to both ends of the slip rings. This test equipment supplies a current up to 10 A through the windings in order to provide a measurement for the resistance of the windings.

Test results >> Enclosure D

7.3.5. AC Impedance test

An AC impedance test was performed.
Test results >> Enclosure F

7.3.6. Pole balance test

Pole balance test could not be performed due to limited access to the Rotor windings. The pole balance test is covered with the RSO (recurrent surge test) see 7.3.7 and test result Enclosure G.

7.3.7. Recurrent surge measurement (RSO)

The recurrent surge test (inter-turn short circuit test) was conducted with the generator rotor not removed from the unit. The results of the test showed no deviation in the superimposed traces and therefore the rotor is considered to be free of inter-turn shorts at stand still.

Test results >> Enclosure G

8. Open Items

Nothing to report

9. Spare parts

Nothing to report

10. Software backup and data

Nothing to report.

11. Appendix

No item included

12. Enclosure

No.	A
Description	Wedge Test
Reference Number	
Pages	1

No.	B
Description	Charging current measurement stator
Reference Number	
Pages	1

No.	C1-C6
Description	ElCid
Reference Number	
Pages	1

No.	C7 - C8
Description	ElCid Stepiron
Reference Number	
Pages	8

No.	D
Description	DLRO Stator and Rotor
Reference Number	
Pages	1

No.	E
Description	Charging current rotor
Reference Number	
Pages	1

No.	F
Description	AC impedance test
Reference Number	
Pages	1

No.	G
Description	RSO (Recurrent surge oscilloscope)
Reference Number	
Pages	1

No.	M
Description	Mainttenance work order
Reference Number	
Pages	1

Enclosure : A

Report No.: G015595 **Holyrood #1** **6/15/2012**

Slot Wedge Testing

Non driven end | Driven end

Slot # \ Wedge #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1	1	1	2	2	2	2	2	2	2	2	1	2	2	2	2	1	2	1	1	1	1	1	2	1	1	1	2	2	1
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66	1	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	1	1	1	2	1	1	1	2	2	2	1	1

1 = tight   2 = 1/3 loose   3 = 2/3 loose   4 = loose   5 = moves

Remarks: There are only 1/3 or less loose wedges

Enclosure : **B**

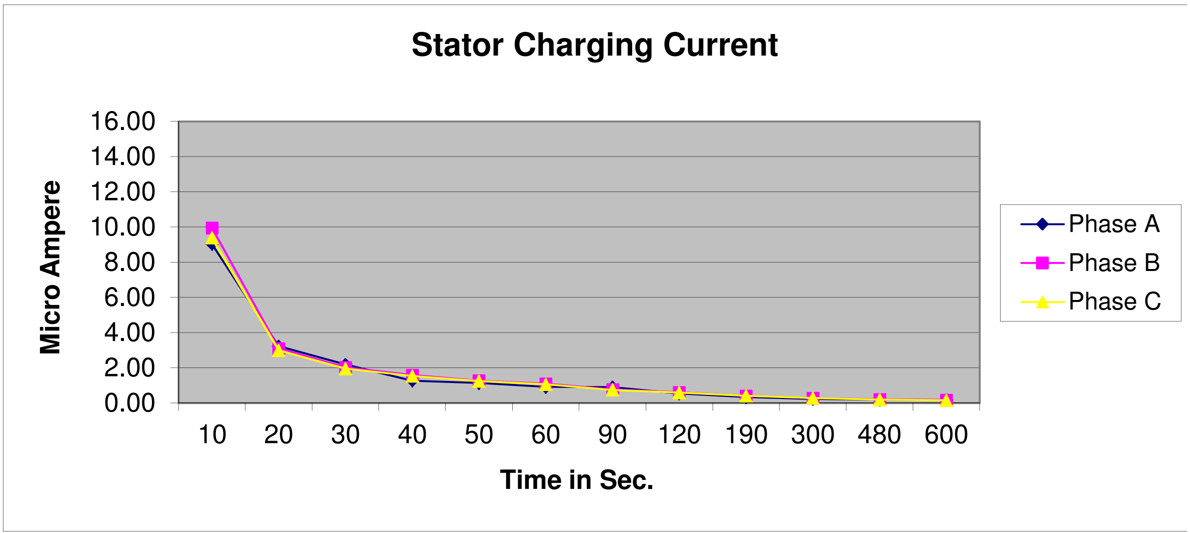
Report No.: **G015595** **Holyrood #1** **6/15/2012**

Charging Current Measurement Stator

Time	Resistance at Winding temp		Resistance at Winding temp		Resistance at Winding temp	
	Phase A		Phase B		Phase C	
Sec	µ Amp.	µ Amp.20 ^{0}C	µ Amp.	µ Amp.20 ^{0}C	µ Amp.	µ Amp.20 ^{0}C
10	12.50	9.06	13.74	9.95	12.95	9.38
20	4.46	3.23	4.27	3.10	4.13	2.99
30	3.03	2.20	2.81	2.03	2.70	1.96
40	1.76	1.28	2.19	1.59	2.12	1.53
50	1.56	1.13	1.76	1.28	1.72	1.25
60	1.26	0.91	1.52	1.10	1.47	1.07
90	1.25	0.91	1.07	0.78	1.03	0.75
120	0.76	0.55	0.84	0.61	0.82	0.59
190	0.47	0.34	0.58	0.42	0.56	0.41
300	0.33	0.24	0.40	0.29	0.38	0.28
480	0.27	0.20	0.28	0.21	0.26	0.19
600	0.23	0.17	0.24	0.17	0.23	0.16

	Winding Actual	Winding 20 ^{0}C	Winding Actual	Winding 20 ^{0}C	Winding Actual	Winding 20 ^{0}C	
R 1 min	3,960	5,466	3,280	4,528	3,400	4,693	M-Ohm
R 10 min	21,400	29,540	21,000	28,988	22,200	30,645	M-Ohm
PI	**5.40**		**6.40**		**6.53**		
Capacitance	**0.42**		**0.42**		**0.41**		**µF**

Test Voltage	5000	V
Ambient Temperature	14.4	^{0}C
Humidity	55.2	%
Winding Temperature	14.4	^{0}C
20 Degree Factor	0.72	

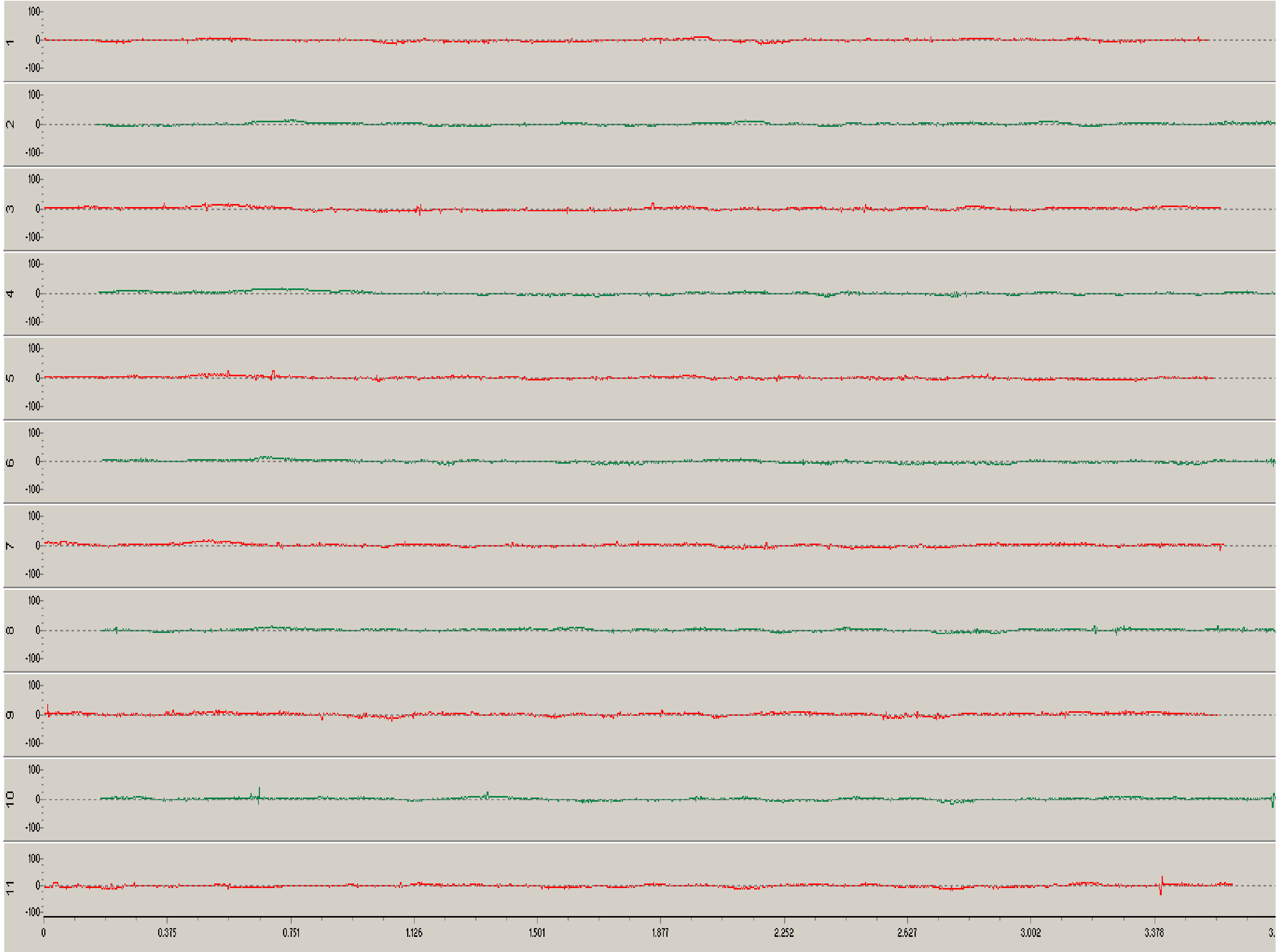


Measurement Conditions				
Test Voltage VDC	Ambient Temperature ^{0}C	Test Instrument	Winding Temperature ^{0}C	Relative Humidity %
5000	14.4	Megger BM25	14.4	55.2

Remarks: Result calculated to reference temperature of 68 ^{0}F (20 ^{0}C)

Enclosure C1

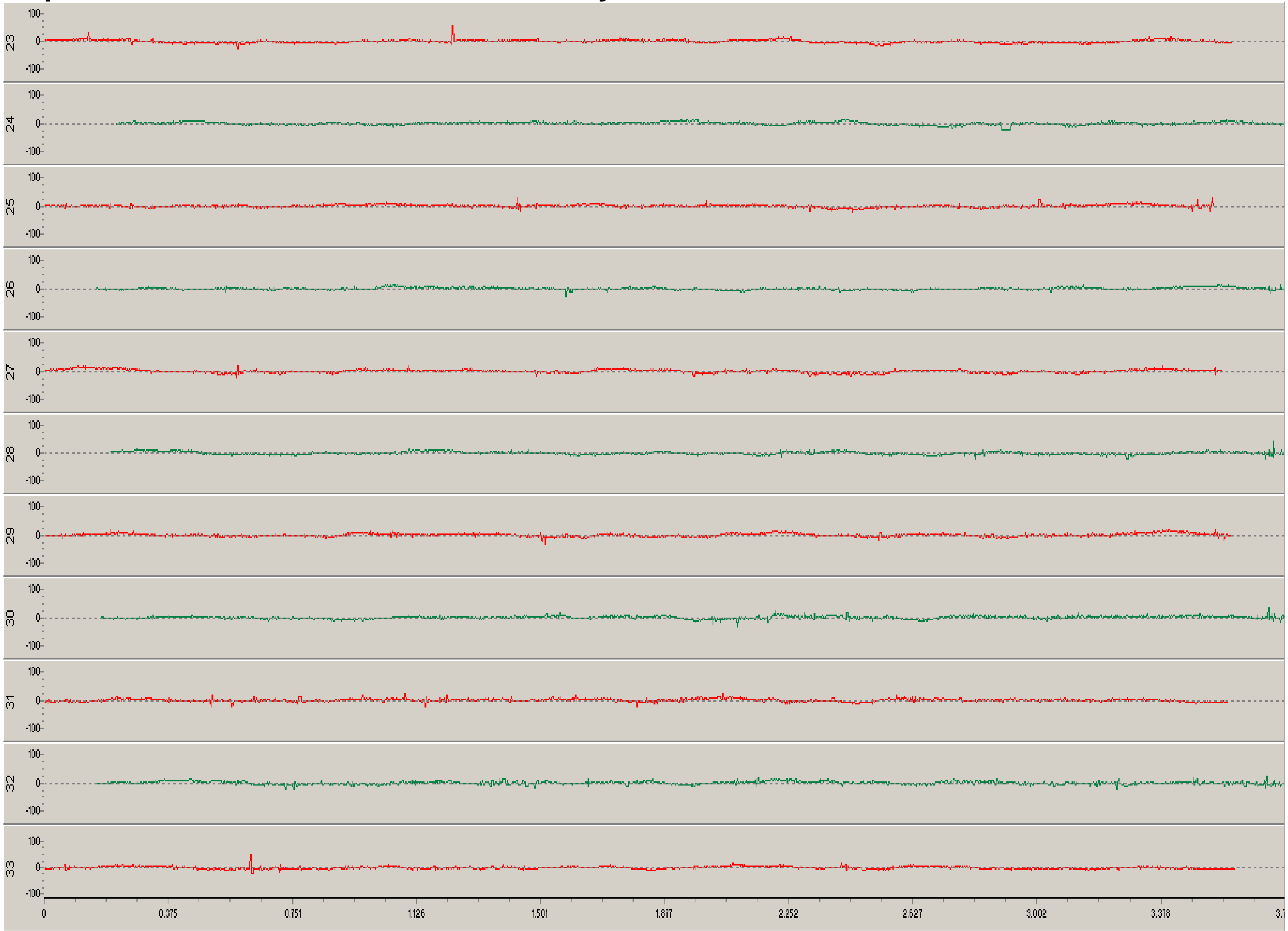
Report No. G015595 Holyrood #1 6/15/2012



Enclosure C2

Report No. G015595 Holyrood #1 6/15/2012

Enclosure C3
Report No. G015595 Holyrood #1 6/15/2012



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Report No. G015595 Holyrood #1 6/15/2012

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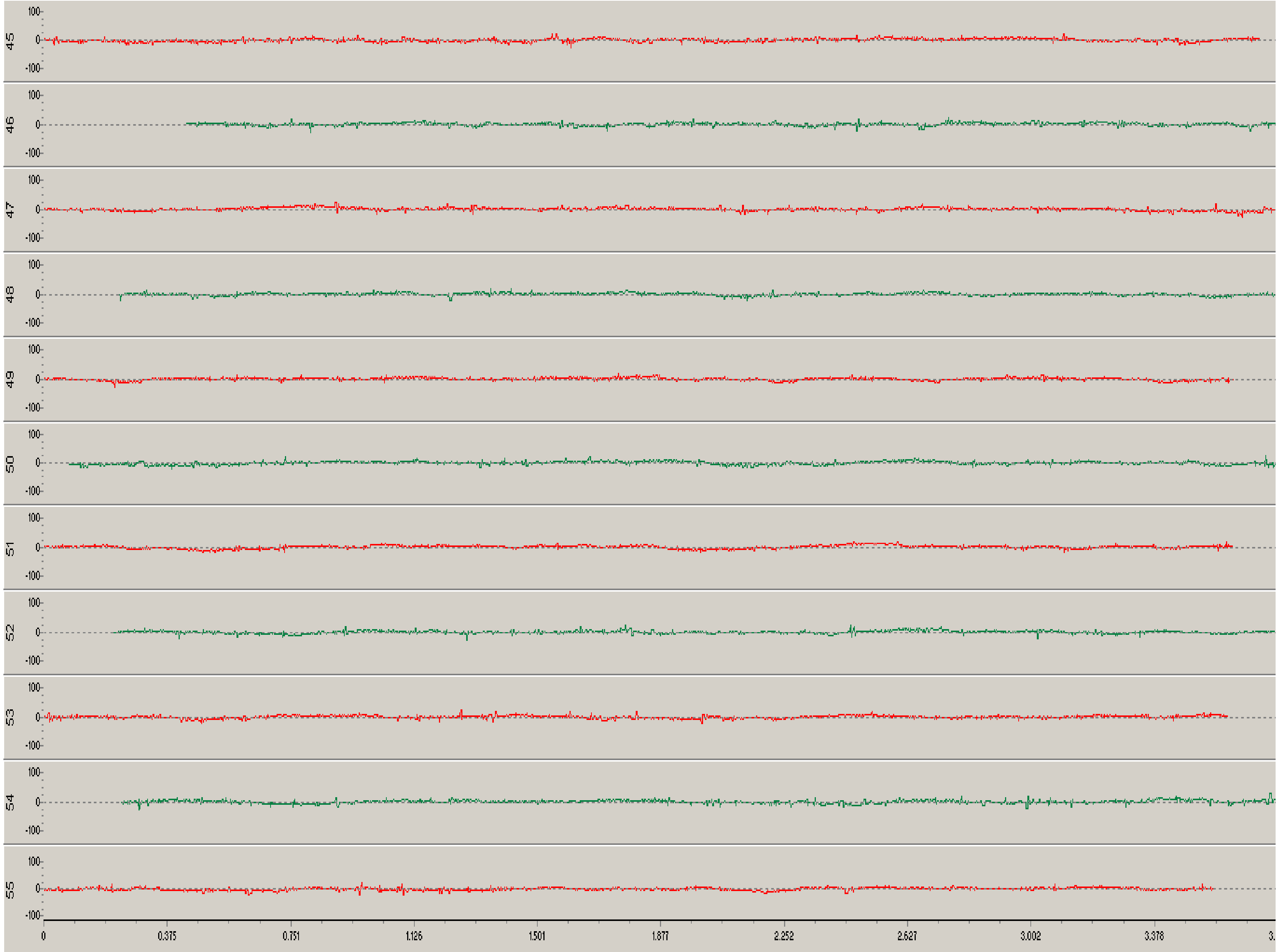
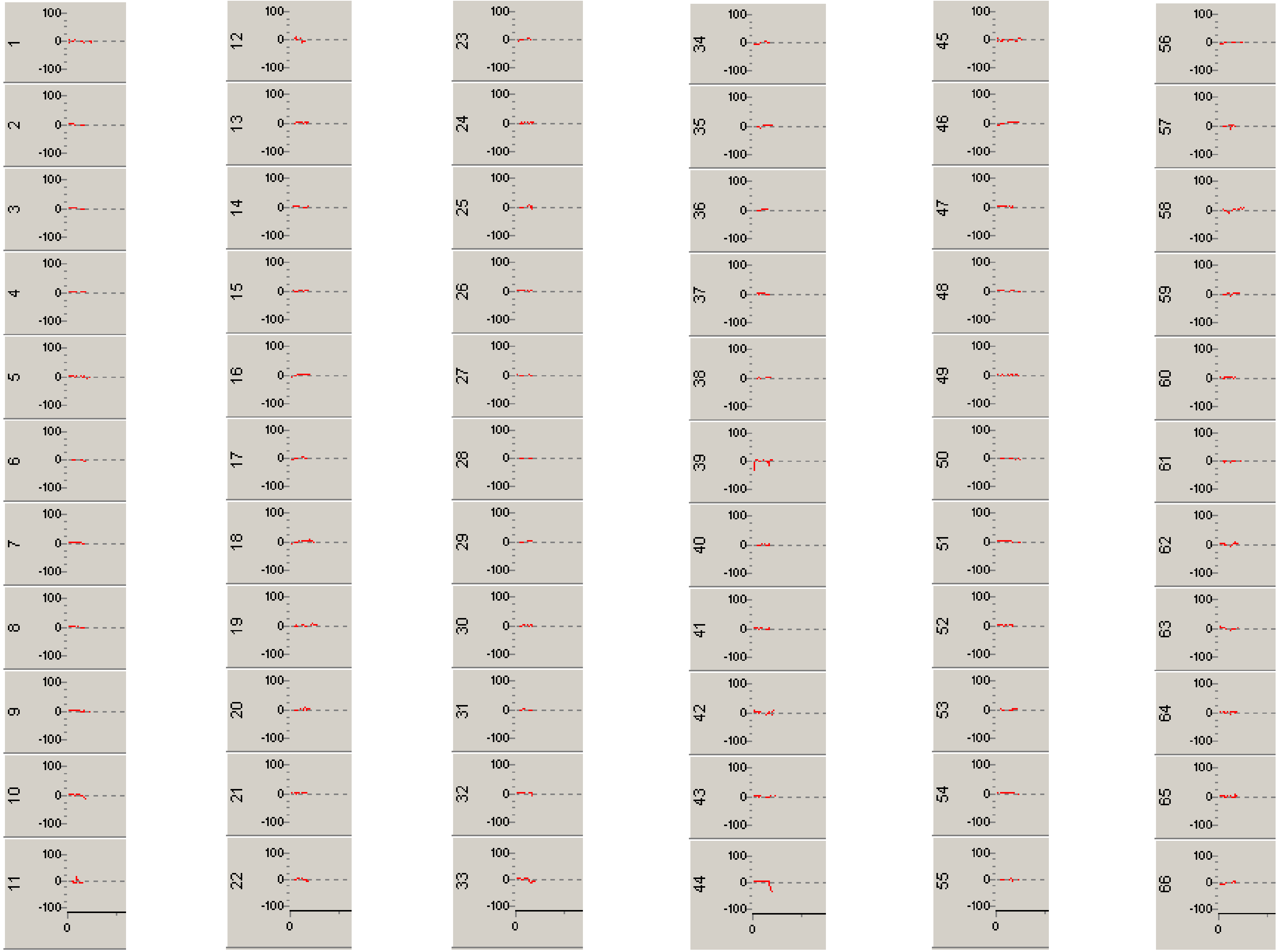


Enclosure C6

Report No. G015595 Holyrood #1 6/15/2012

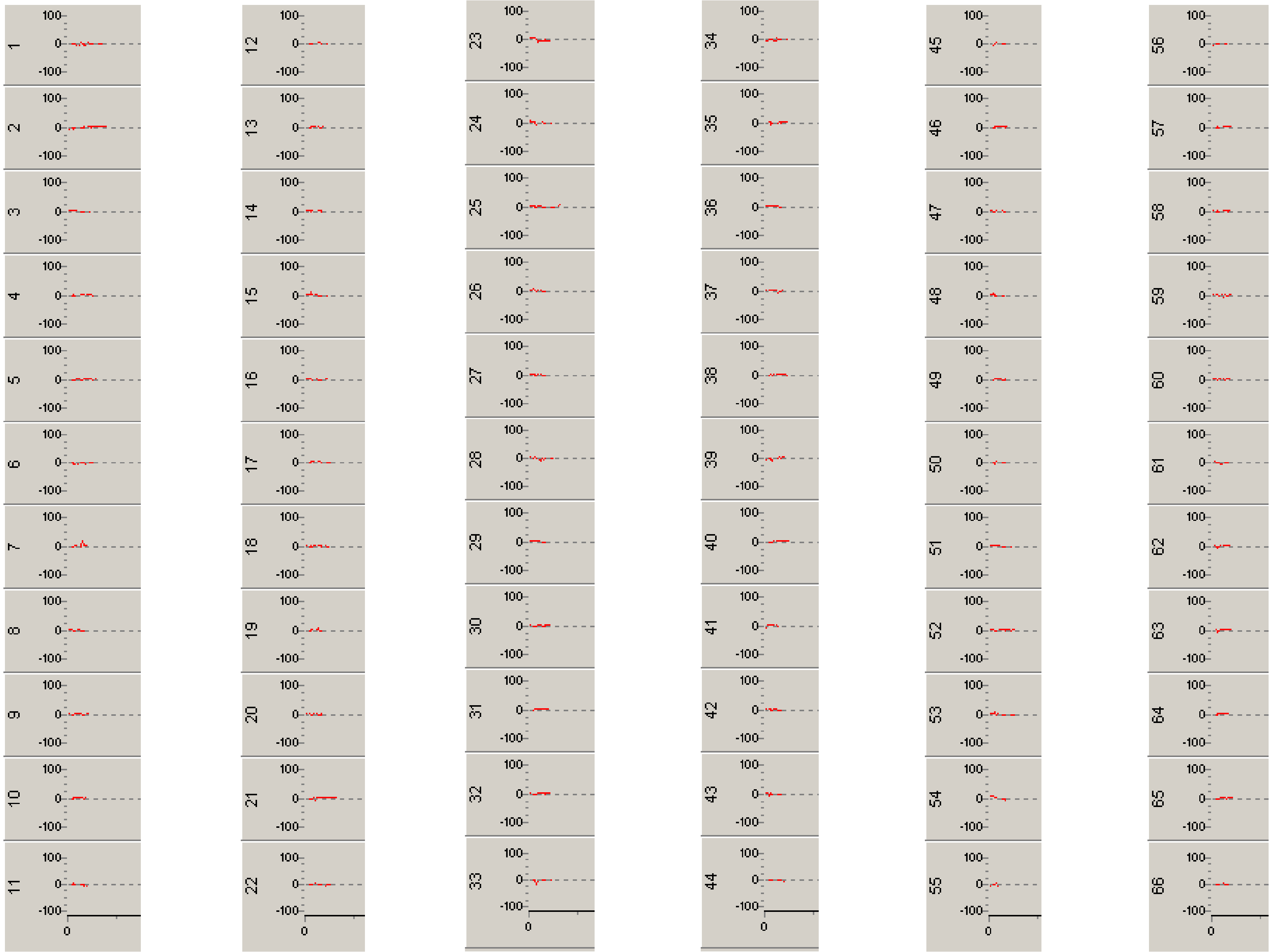
Enclosure C7
Report No. G015595 Holyrood #1 Stepiron DE 6/15/2012



Enclosure C8
Report No. G015595

Holyrood #1 Stepiron NDE

6/15/2012



Enclosure : D

Report No.: G015595 Holyrood #1 6/15/2012

DLRO Testing Stator and Rotor

An impedance test on the stator winding was performed by connecting the test leads of the DLRO (Digital Low Resistance Ohmmeter) to both ends of the phase bar. This test equipment supplies a current up to 10A through the winding in order to provide a measurement for the resistance of the windings.

Stator Windings

Actual winding temperature	17.1

Phase A	Forward	Backward	Average	20^0C	Remarks
Test 1	1.179	1.195	1.187	1.201	1A
Test 2	1.183	1.192	1.1875	1.201	1A
Test 3	1.182	1.191	1.1865	1.200	1A
Average of all 3 Tests			1.187	1.201	

Phase B	Forward	Backward	Average	20^0C	Remarks
Test 1	1.175	1.187	1.181	1.195	1A
Test 2	1.178	1.18	1.179	1.192	1A
Test 3	1.181	1.185	1.183	1.197	1A
Average of all 3 Tests			1.181	1.195	

Phase C	Forward	Backward	Average	20^0C	Remarks
Test 1	1.192	1.2	1.196	1.210	1A
Test 2	1.208	1.199	1.204	1.217	1A
Test 3	1.202	1.199	1.201	1.214	1A
Average of all 3 Tests			1.200	1.214	

Rotor Winding

Stator	Forward	Backward	Average	20^0C	Remarks
Test 1	106.6	235.2	170.9	172.85	10 mA
Test 2	98.4	240	169.2	171.14	10 mA
Test 3	103.1	235.1	169.1	171.03	10 mA
Average of all 3 Tests			169.73	171.67	

All measurements are in m Ohm

Measurement Conditions					
		Ambient Temperature ^0C	Test Instrument	Winding Temperature ^0C	Relative Humidity %
		17.1	Megger DLRO 10 X	17.1	54

Remarks: Test on Generator Stator was performed at the at the busbars outside the Generator.
Test on Generator Rotor was performed at the sliprings

Enclosure : **E**

Report No.: **G015595** **Holyrood #1** **6/15/2012**

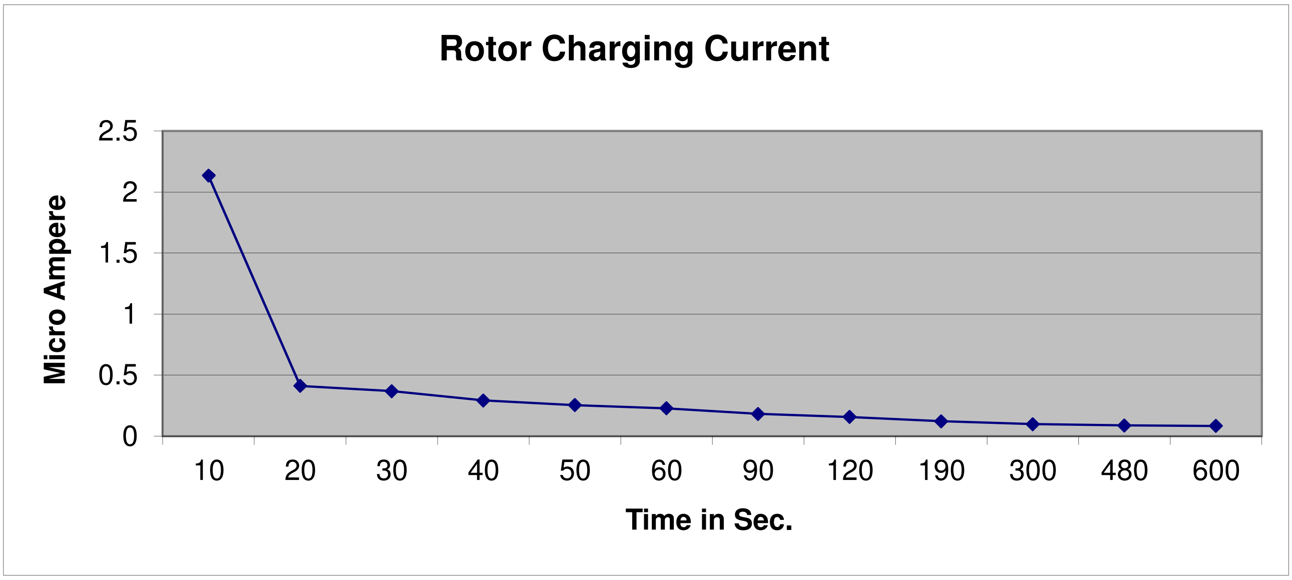
Charging Current Measurement Rotor

Time	Resistance at Winding temp	
Sec	M-Ω	µ Amp.
10	234	2.14
20	1210	0.41
30	1350	0.37
40	1700	0.29
50	1960	0.26
60	2180	0.23
90	2740	0.18
120	3160	0.16
190	4060	0.12
300	5050	0.10
480	5650	0.09
600	5900	0.08

Test Voltage	500	V
Ambient Temperature	17.1	^{0}C
Humidity	54	%
Winding Temperature	17.1	^{0}C
20 Degree Factor	0.85	

	Winding Actual	Winding 20 ^{0}C	
R 1 min	2180	1845	M-Ohm
R 10 min	5900	4993	M-Ohm

PI	**2.71**



Measurement Conditions				
Test Voltage VDC	Ambient Temperature ^{0}C	Test Instrument	Winding Temperature ^{0}C	Relative Humidity %
500	17.1	Megger BM 25	17.1	54

Remarks: Result calculated to reference temperature of 68 ^{0}F (20 ^{0}C)

Enclosure : F
Report No.: G015595 Holyrood #1 6/15/2012

AC IMPEDANCE TEST ROTOR

Voltage	Current in Ampere	Resistance in Ohm
10	1.5	6.67
20.07	2.96	6.78
30.16	4.36	6.92
40.3	5.7	7.07
50.2	6.97	7.20
60	8.19	7.33
70.2	9.45	7.43
80.1	10.69	7.49
90.1	11.76	7.66
100.1	12.79	7.83

Measurement Conditions					
		Ambient Temperature ^{0}C	Test Instrument	Winding Temperature ^{0}C	Relative Humidity %
		17.1	Variac	17.1	54

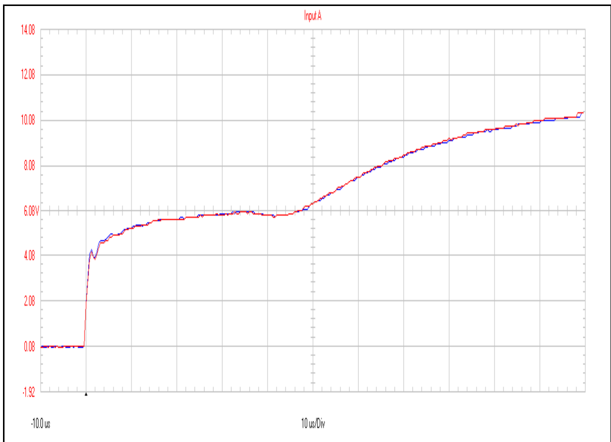
Remarks: There is no historic data for a AC imdedance test available

Enclosure G

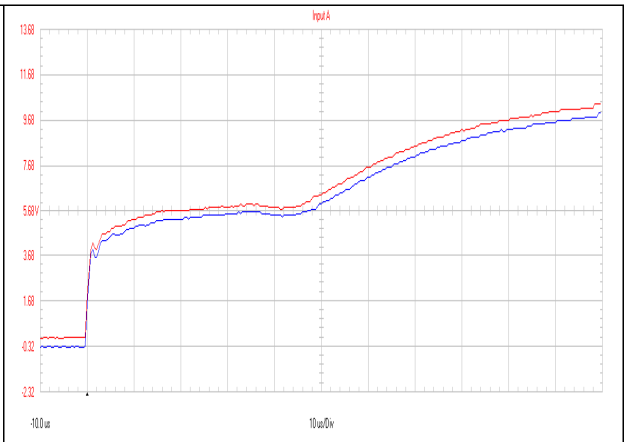
Report No.G015595 Holyrood #1 6/15/2012

Recurrent Surge Test Results

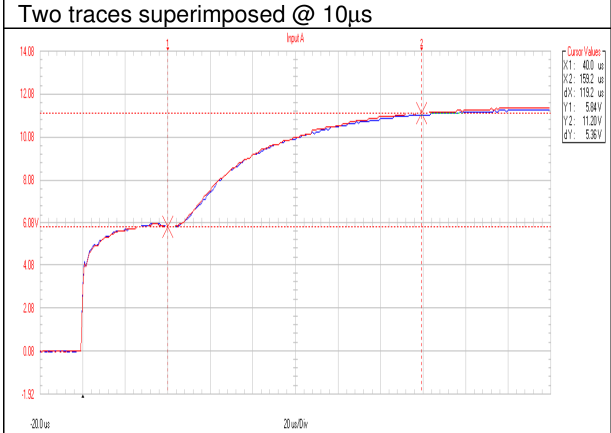
The recurrent surge test equipment supplies a voltage impulse with a fast rise time and has a specific input and output impedance. The impulse voltage is feed through 1 slip ring and then the other. The resulting traces are recorded and stored on an oscilloscope. When a fault is present the two-recorded traces exhibit different progressions.



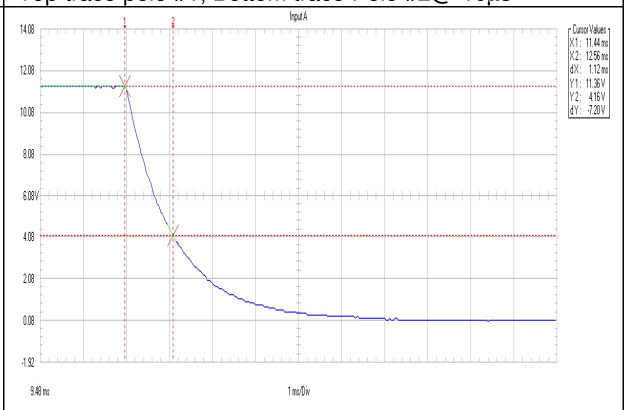
Two traces superimposed @ 10µs



Top trace pole #1, Bottom trace Pole #2@ 10µs



Two traces superimposed @ 20µs



Remarks*:*

Surge generator setting	RF	2200 Ohm
Surge generator setting	Rv	95 Ohm
Impuls transition time	T	21.2 µs
Discharge time constant	T_E	1.12 ms
Winding ground capacitance	C_E	0.488 µF
Surge impedance	R_W	43.44 Ohm

Remarks*:* There is no deviation in the super imposed traces and there for the rotor is consider free of inter-turn shorts during Standstill.

Enclosure M

Report No. G015595 Holyrood#1 6/15/2012

Maintenance Work Order

Stator

- Clean dirt from drive and non-drive end windings, core and lower frame in accordance with Alstom Power procedure HTZW 23170 (cleaning electrical machines).
- Clean all Bushings
- Clean Generator Junction Box from dust and oil
- Clean Flex-links connection and apply contact grease before reassembly
- Check RTD's

Rotor

- Clean dirt from rotor in accordance with Alstom Power procedure HTZW 23170 (cleaning electrical machines).
- .

ALSTOM

Field Service Report (FSR)	Related CFSR issued ☐ Y ☒ N	Total pages without enclosures	Total pages enclosures
Report No. **FSRG015977**		6	85

Location	Department	Author	Date	Page No.
US	Thermal Services	Shahram Elmi	10.08.2012	1

Site Information

Customer	File Name	
Newfoundland And Labrador Hydro	FSRG015977_Assessment_120810_Elmi.pdf	
Site: **HOLYROOD**	Country Name: CANADA	PDM Event No.
Plant: **HOLYROOD 1**	Plant Type: FO	Outage code
Unit: **HOLYROOD 1**	Service Ref No.	Order No.

System / Machine	System / Machine Type	System / Machine Serial No.
Generator	Stator	GE HYDROGEN COOLED

Task Information

Business Case
A/B- Inspection

Task
Assessment (Inspection)

Task description

Bump Test Report

Distribution of FSR

Authors Distribution List				Official Distribution List			
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US	Thermal Services	Reviewed by Nathalie Muelhaupt	14.08.2012
US	Thermal Services	Approved by John A Jensen	17.08.2012
US	Thermal Services	Archived by Bianca K Figueroa	17.08.2012

TABLE OF CONTENT

1. Summary

Holyrood unit #1 is a GE indirect hydrogen cooled generator. The stator is rated at 174 MW and has 66 slots. Tangential blockings are not used between the series caps of the Driven End (DE) or the series caps of the Non-Driven End (NDE); however, the top bar and bottom bar phase connections are tied together at two locations. During a scheduled outage in June 2012, bump testing of the Non Driven End (NDE) and Driven End (DE) of the end windings was performed. The bump testing included:

- NDE Linearity test
- NDE Reciprocity test
- NDE Global modal analysis
- NDE Driving point measurement of the series caps
- NDE Driving point measurements of the phase connections
- DE Linearity test
- DE Reciprocity test
- DE Global modal analysis
- DE Driving point measurement of the series caps

The results from the global modal analyses indicated that the frequencies of the 4-node elliptical mode shapes occurred at 72 Hz, 76 Hz, 82 Hz, and 93.5 Hz for the NDE end winding. In the case of the DE end winding, the frequencies of the elliptical mode shapes occurred at 81 Hz, 84 Hz, and 89.5 Hz. All the natural frequencies corresponding to the elliptical mode shapes were well below the critical range of 115 Hz to 135 Hz, and therefore within ALSTOM acceptance criterion.

The magnitudes of vibration of the driving point measurements of the series caps of the NDE and DE end windings were relatively small in the radial and axial directions (even though the impact was made in the radial direction), however, in the tangential direction, the magnitudes of vibration of some of the caps were more than 5E-7 m/N (500 nm/N) and therefore exceeding ALSTOM acceptance criterion.

The magnitudes of vibration of the phase connections and their corresponding phase arms in the radial and axial directions were also relatively small, but the magnitudes of vibration for some of the phase connections in the tangential direction were greater than 5E-7 m/N (500 nm/N) and therefore exceeding ALSTOM acceptance criterion.

The characteristic of the end windings would change over time since the end windings are subjected to the mechanical and thermal stresses during start-stops and operation. Hence the magnitudes of vibration may increase and the natural frequencies may shift to the critical range. Therefore, ALSTOM recommends that the bump testing of the end windings be repeated during next opportunity.

The purpose of this report is to describe the procedure and equipment used, and present the results obtained.

2. Summary internal

Nothing to report

3. Purpose and duration of assignment

Purpose of assignment	Arrival Date	Departure Date
Perform bump testing of the Holyrood #1 end windings per UTGE602042	07.06.2012	12.06.2012

4. Milestones

Nothing to report

5. Personnel involved

Unit		HOLYROOD 1					
No.	Name	Department	Code	Function	Position	Arrival Date	Departure Date
1	Shahram Elmi	Gen Ser	CGD	Commissioning Generator Diagnostics	Engineer	07.06.2012	12.06.2012

6. Operation data

Nothing to report

7. Technical information

Unit		HOLYROOD 1		
Type of data		Technical Information Generator		
No.	Description	Unit	Reading / Value	Remarks
1	Type	-	GE HYDROGEN COOLED	
2	Generator / Stator Serial No.	-	980485	
3	Manufacturer (OEM) / Supplier	-	GE	
4	Rotor Serial No.	-		
5	Rated Speed	rpm	3600	
6	Rated Frequency	Hz	60	
7	Rated Apparent Power	kVA	194455	
8	Rated Power Factor	-	0.90	
9	Rated Stator Voltage	kV	16.00	
10	Rated Stator Current	A	7016	
11	Rated Field Voltage	kV_{DC}	375.000	
12	Rated Field Current	A_{DC}	1864	
13	Insulation system	(stator wind.)		
14	Insulation class	(stator wind.)		
15	Cooling System (medium)	(rotor/stator)	H2-Indirect	
16	Excitation System	-		
17	Exciter Type	-		
18	Exciter Fabrication No.	-		

8. Work carried out

8.1. Bump Testing

Bump testing of the Non Driven End (NDE) and Driven End (DE) of the end windings was performed. The bump testing included:

- NDE Linearity test
- NDE Reciprocity test
- NDE Global modal analysis
- NDE Driving point measurement of the series caps
- NDE Driving point measurements of the phase connections
- DE Linearity test
- DE Reciprocity test
- DE Global modal analysis
- DE Driving point measurement of the series caps

The measurements were performed according to ALSTOM document UTGE602042. In addition to the requirements in the above procedure, the following steps were also added:

- For the Global modal analyses of both the NDE and DE sides, four different measurement planes were chosen. The first plane was taken at slot exit, the second plane was chosen at the midsection of the involutes, the series caps were picked as the third plane, and finally the supporting brackets were chosen as the fourth plane. The number of measurement points was 71 for the NDE side and to 72 for the DE sides.
- The phase connections were bumped separately from the series caps of the NDE side.
- The phase connection and the corresponding arms were bumped in radial, tangential, and axial directions and the responses in all three directions were measured. On each phase connection, the vibration responses were measured at two different points, one before the first block and the second between the two blocks. Figure 3 shows the blocking between the two adjacent phase connections and the locations of the accelerometers.

- All the sixty-six caps of the DE side and the sixty series caps of the NDE side were bumped in radial directions and their responses were measured in radial, tangential, and axial directions.

For the complete report, list of equipment, and the graphs of the results of the above tests, refer to the enclosure section at the bottom of this report.

9. Work carried out internal

Nothing to report

10. Open Items

Nothing to report

11. Open Items internal

Nothing to report

12. Instruments and tools internal

Nothing to report

13. Spare parts

Nothing to report

14. Software backup and data

Nothing to report.

15. Feedback and experiences internal

Nothing to report

16. Sales opportunities internal

Nothing to report

17. EHS Internal

Nothing to report

18. Competitor activities internal

Nothing to report

19. FSI internal

Nothing to report

20. NCR internal

Nothing to report

21. Appendix

No item included

22. Appendix internal

No item included

23. Enclosure

No.	1
Description	Complete Report
Reference Number	
Pages	85

24. Enclosure internal

No enclosures

NALCOR ENERGY COMPANY

HOLYROOD UNIT #1

Modal Analyses of DE and NDE End Windings,
Driving Point Measurements of Phase Connections and Series Caps

By:
Shahram Elmi

June 12, 2012

Table of Content:

1. Introduction

Holyrood unit #1 is GE indirect hydrogen cooled generator. The stator is rated at 174 MW and has 66 slots. Tangential blockings are not used between the series caps of the Driven End (DE) or the series caps of the Non-Driven End (NDE). However, the top bar and bottom bar phase connections are tied together at two locations. During a scheduled outage in June 2012, bump testing of the Non Driven End (NDE) and Driven End (DE) of the end windings were performed. The bump testing included:

- NDE Linearity test
- NDE Reciprocity test
- NDE Global modal analysis
- NDE Driving point measurement of the series caps
- NDE Driving point measurements of the phase connections
- DE Linearity test
- DE Reciprocity test
- DE Global modal analysis
- DE Driving point measurement of the series caps

The purpose of this report is to describe the procedure and equipments used, and present the results obtained.

Figure 1. NDE view of the end winding

Phase connections are tied together for support

No tangential blocking provided between the series caps

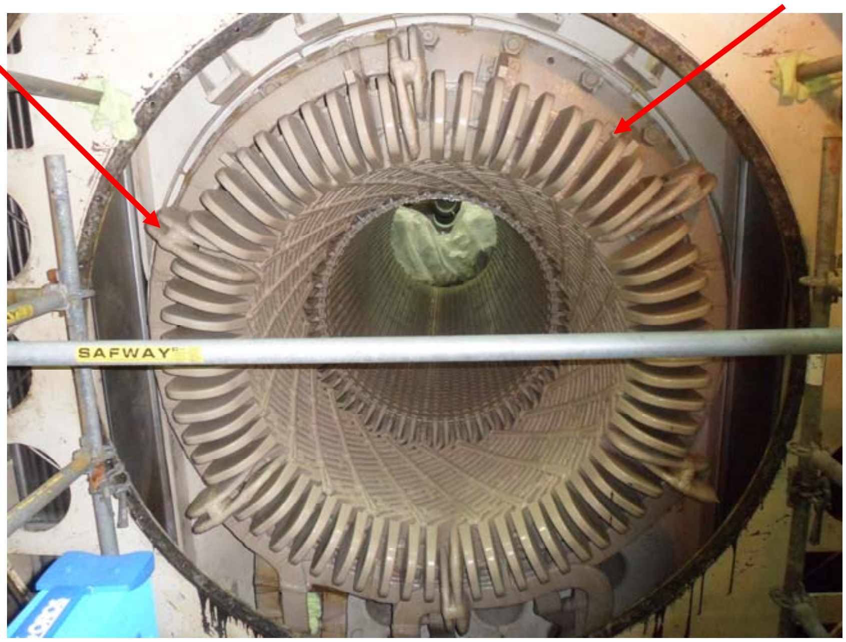
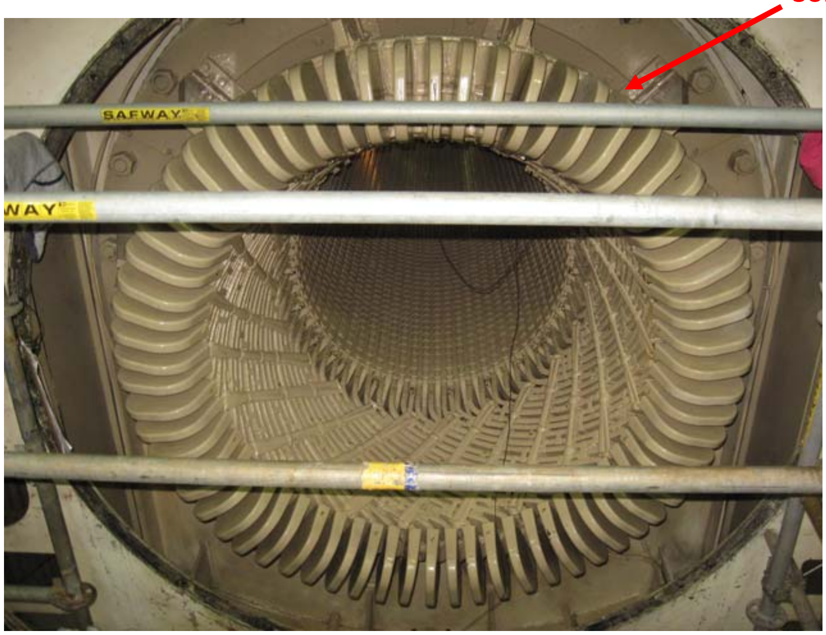


Figure 2. DE view of the end winding

No tangential blocking provided between the series caps



2. Setup and Procedures

The measurements were performed according to ALSTOM document number UTGE602042. In addition to the requirements in the above procedure, the following steps were also added:

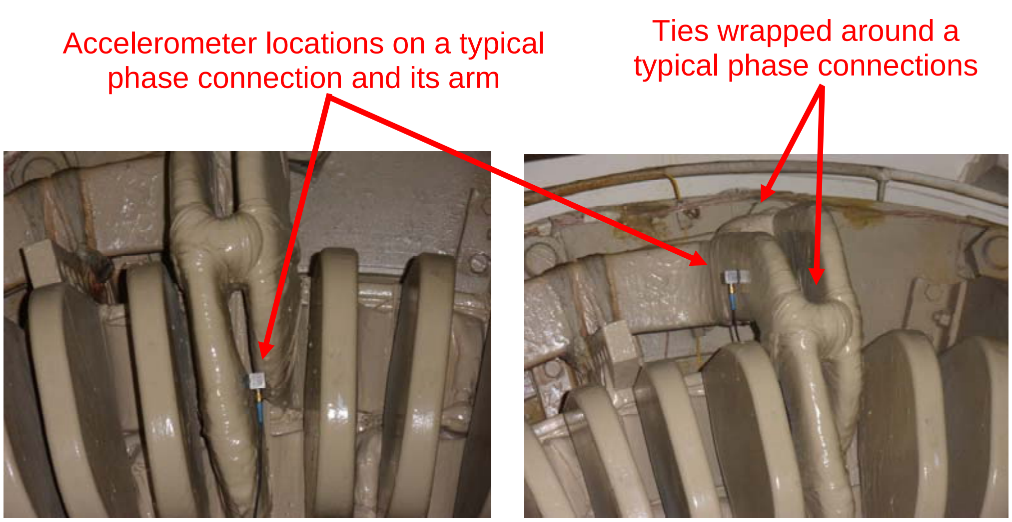
- For the Global modal analyses of both the NDE and DE sides, four different measurement planes were chosen. The first plane was taken at slot exit, the second plane was chosen at the midsection of the involutes, the series caps were picked as the third plane, and finally the supporting brackets were chosen as the fourth plane. The number of measurement points was 71 for the NDE side and to 72 for the DE sides.

- The phase connections were bumped separately from the series caps of the NDE side.

- The phase connection and the corresponding arms were bumped in radial, tangential, and axial directions and measured the responses in all three directions. On each phase connection, the vibration responses were measured at two different points, one before the first block and the second point between the two blocks. Figure 3 shows the blocking between the two adjacent phase connections and the locations of the accelerometers.

- All the sixty-six caps of the DE side and the sixty series caps of the NDE side were bumped in radial directions and their responses were measured in radial, tangential, and axial directions.

Figure 3. Accelerometer locations for the driving point Measurements on a typical phase connection



3. Equipments

The following equipments were used during measurements:

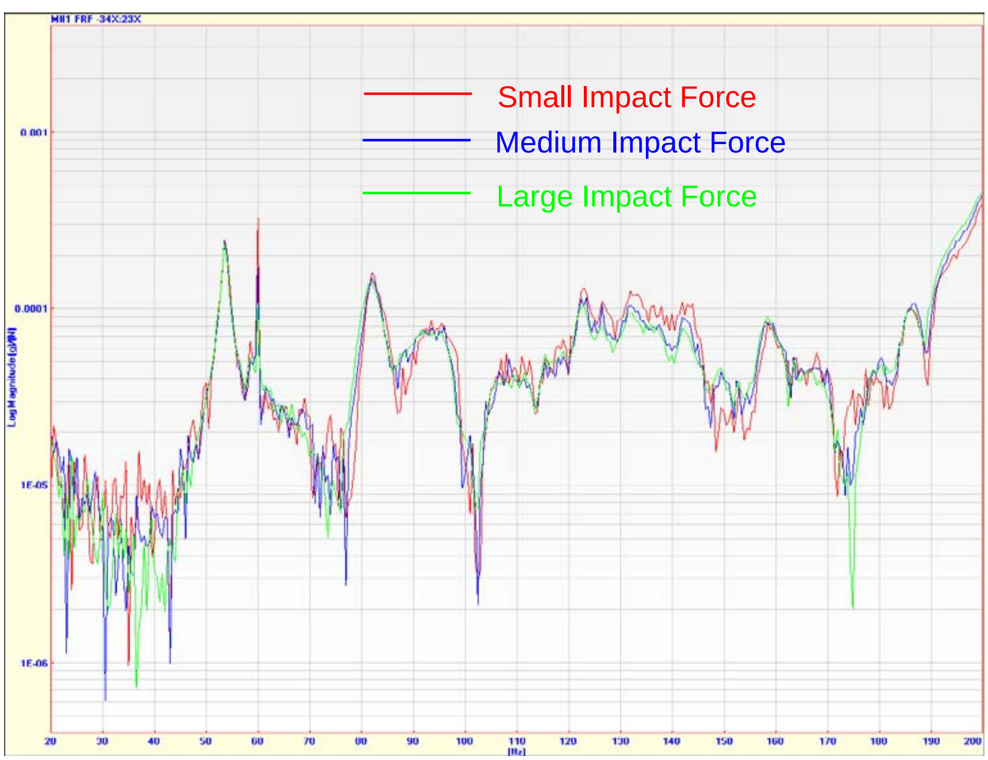
- HP controller #2 with ME Scope software version 5.1.2011.0701
- OROS data acquisition model OR36-8, system #2
- Dytran impact hammer model #582AT, S/N: 1952
- Dytran Tri-axial accelerometer model #3093BIT, S/N: 2512
- ME Scope analysis software version 5.1.2011.0701

4. NDE Measurements

<u>NDE Linearity Test</u>

The linearity test was performed by impacting the midsections of the NDE involutes at 6:00 o'clock with three different magnitudes of the impulsive force and measuring the magnitudes of vibration at 12:00 o' clock. The traces of the measured frequency response functions are shown in figure 4. The traces overlap each other closely.

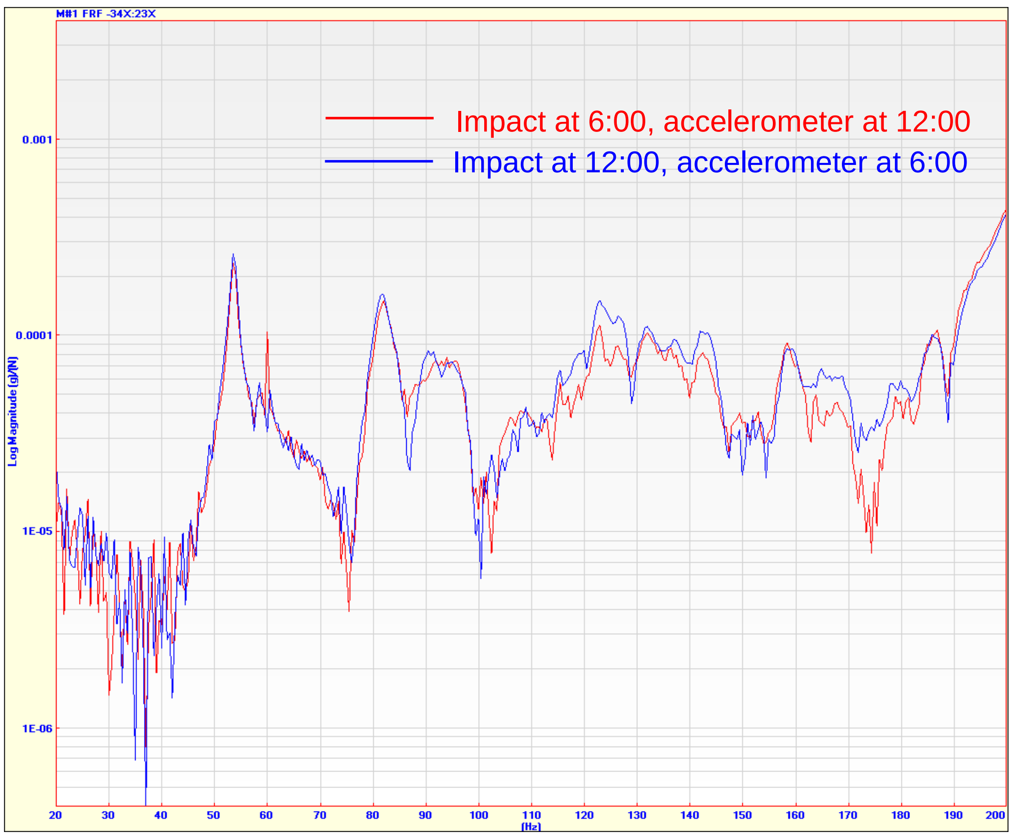
Figure 4. Overlay of traces of frequency response functions from NDE linearity test due to three levels of impact force



NDE Reciprocity Test

The reciprocity test was performed by impacting the midsection of the involutes at 6:00 o'clock and measuring the vibrations at 12:00 o'clock, and then impacting at 12:00 o'clock while measuring the vibrations at 6:00 o'clock. The results are plotted in figure 5 and as is shown the traces are overlapping closely specially below 150 Hz.

Figure 5. Overlay of traces of frequency response functions from NDE reciprocity test

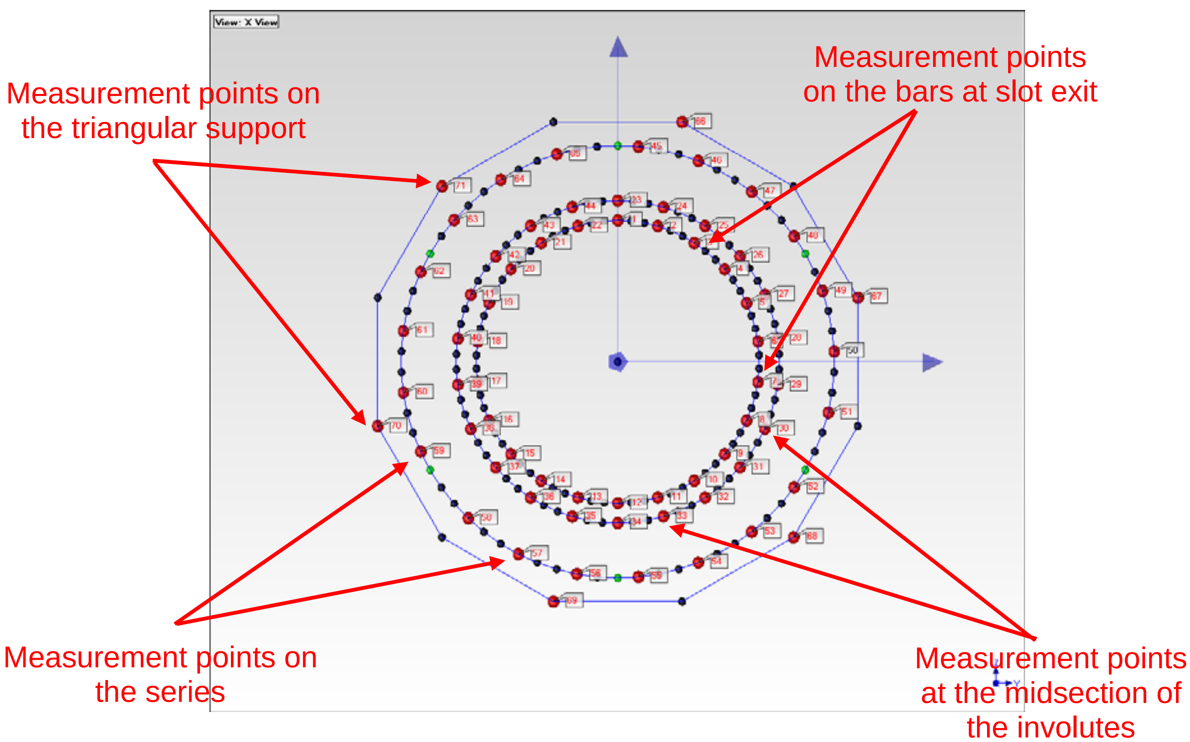


NDE Global Modal Analysis

The global modal analysis of the NDE end winding was performed by impacting at the midsection of the involutes at 06:00 o'clock (see figure 6) and measuring the vibrations of the bars at slot exit, on the midsection of the involutes, on the series caps, and on the supporting brackets. As shown in Figure 7 the vibrations at the slot exit, and at the midsection of the involutes were measured on every third bar for a total of 44 measurement points. On the series caps, also, the measurements were taken on every third cap skipping the phase connections for a total of 21 measurement points. The vibrations of six out twelve brackets were also measured.

Figure 6 Impacting point for the NDE global modal analysis

Figure 7 Circumferential locations of the NDE end windings



The following table summarizes the natural frequencies and the corresponding mode shapes found by the bump test:

Table 1. NDE End Winding
Natural Frequencies and Corresponding Mode Shapes

	Frequency (Hz)	Mode Shape	Note
1	53.5	2-node Circular	See Figure 8-1
2	58	2-node Circular	See Figure 8-2
3	60	Irrigular	
4	72	4-node Elliptical	See Figure 8-3
5	76	4-node Elliptical	See Figure 8-4
6	82	4-node Elliptical	See Figure 8-5
7	93.5	4-node Elliptical	See Figure 8-6
8	105	6-node 3-Lobe	See Figure 8-7
9	110	8-node 4 Lobe	See Figure 8-8
10	Higher Frequency	8-node 4 Lobe	
11			

Figures 8-1 and 8-2 show bending modes shapes of the NDE end windings at 53.5 Hz, and 58 Hz, respectively. . Figures 8-3 through 8-6 show a well-established elliptical mode shapes at frequencies of 72 Hz, 76 Hz, 82 Hz, and 93.5 Hz, respectively. Figure 8-7 shows a 3-Lobe triangular mode shape at 105 Hz, while Figure 8-8 shows a 4-Lobe mode shape at 110 Hz. There were higher natural frequencies than 110 Hz, but there were all 4-Lobe mode shapes. The rotating field will not excite any of the above mode shapes.

Figure 8-1 NDE mode shape at 53.5 Hz

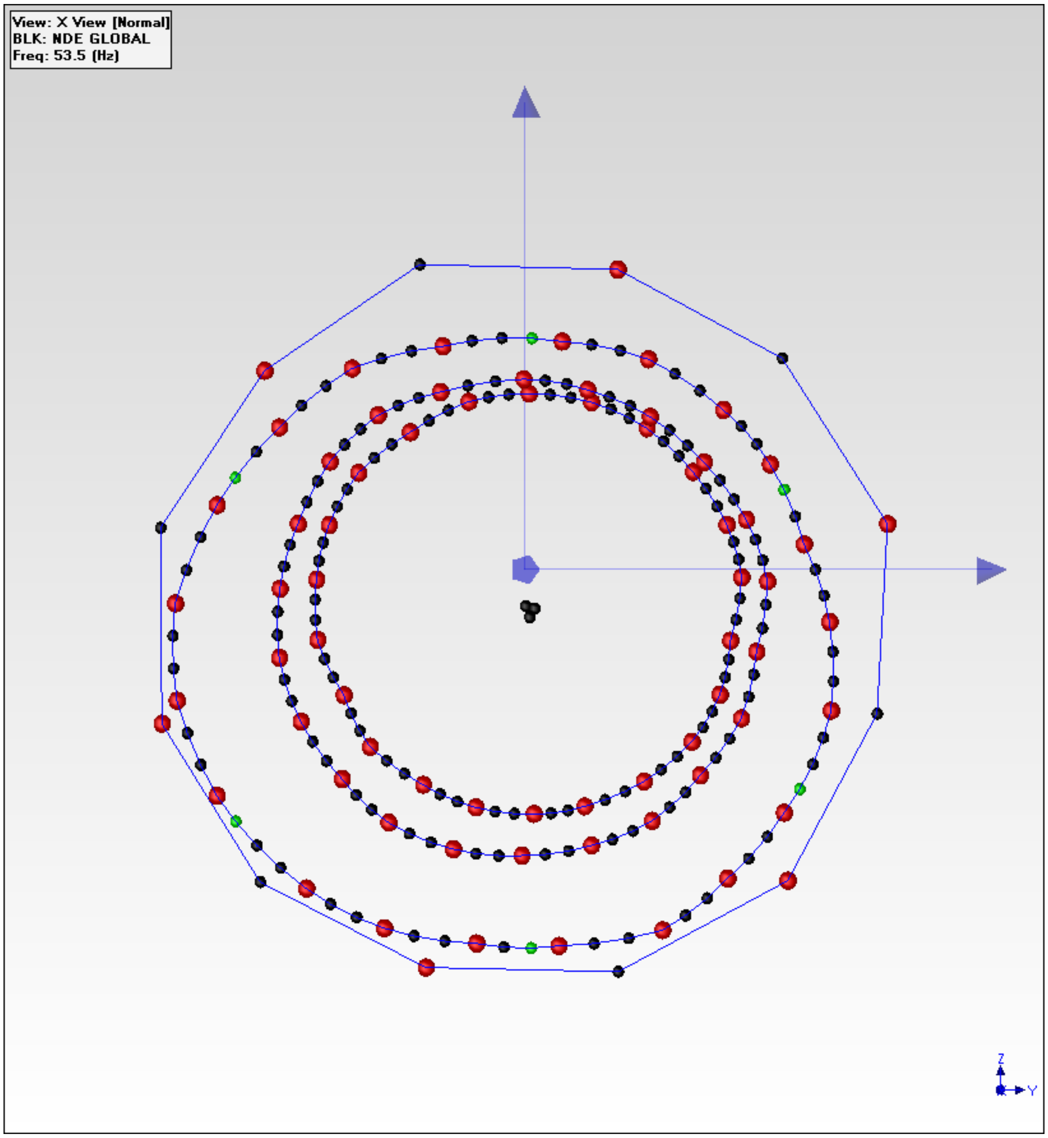


Figure 8-2 NDE mode shape at 58 Hz

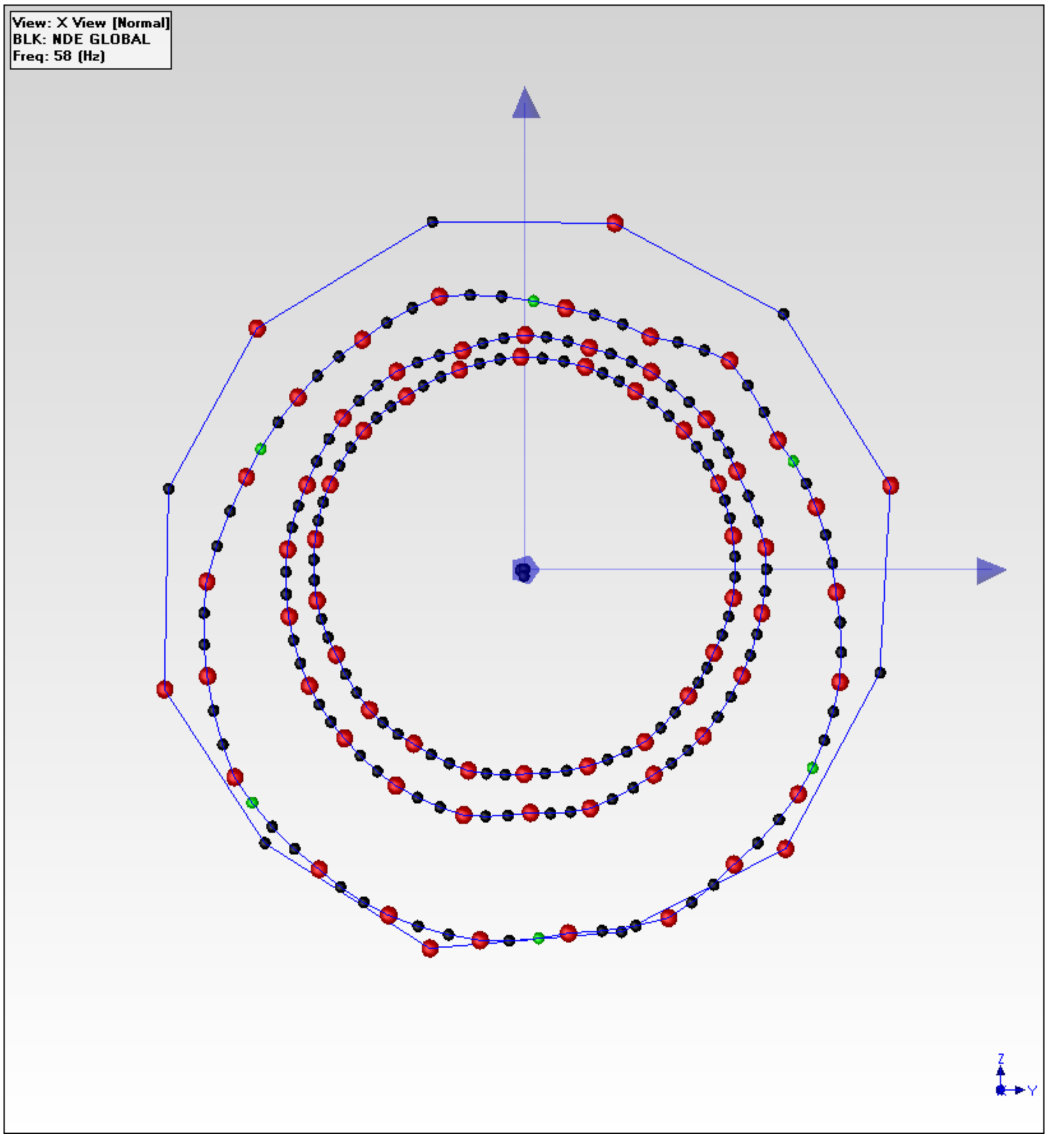


Figure 8-3 NDE mode shape at 72 Hz

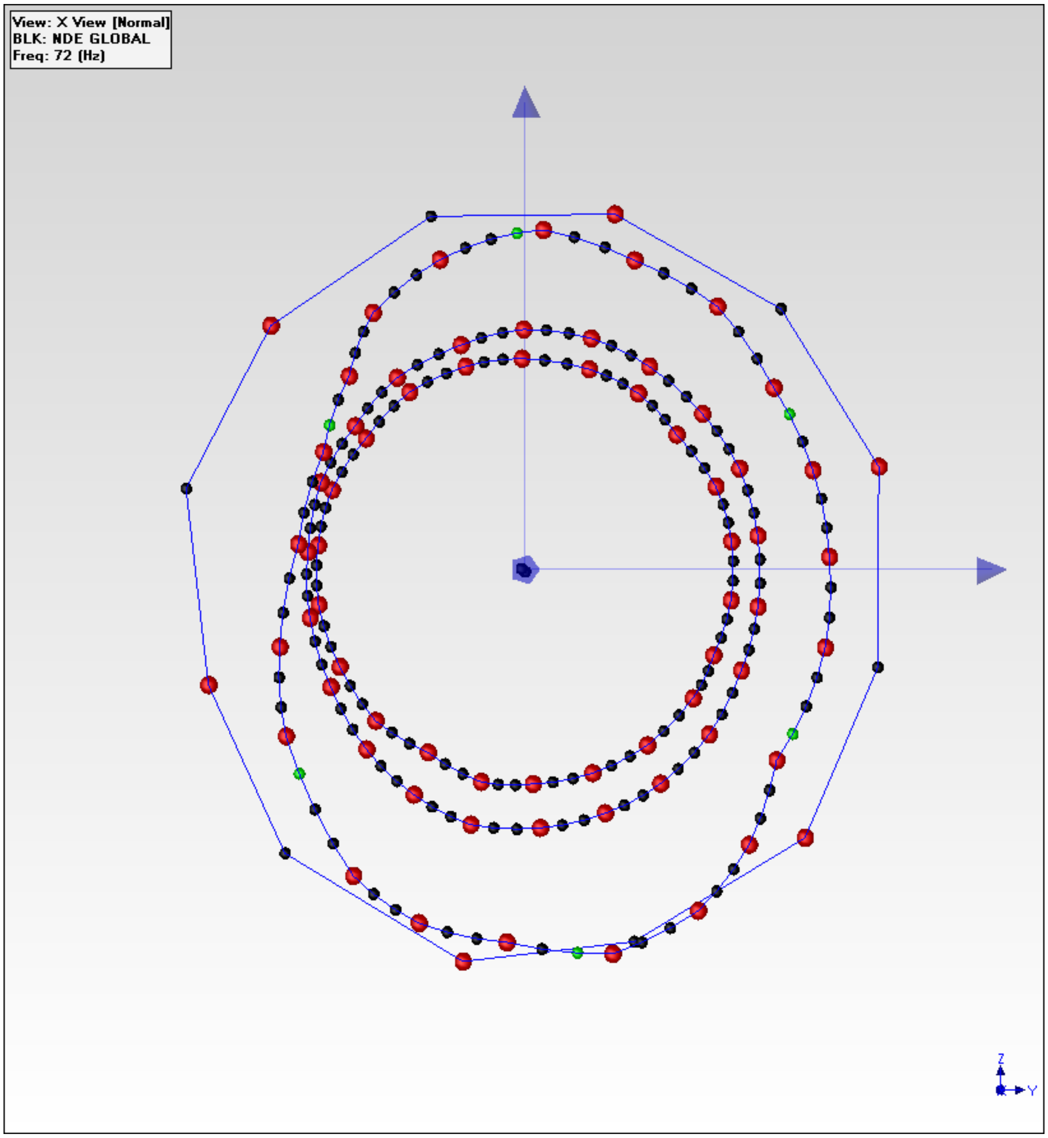


Figure 8-4 NDE mode shape at 76 Hz

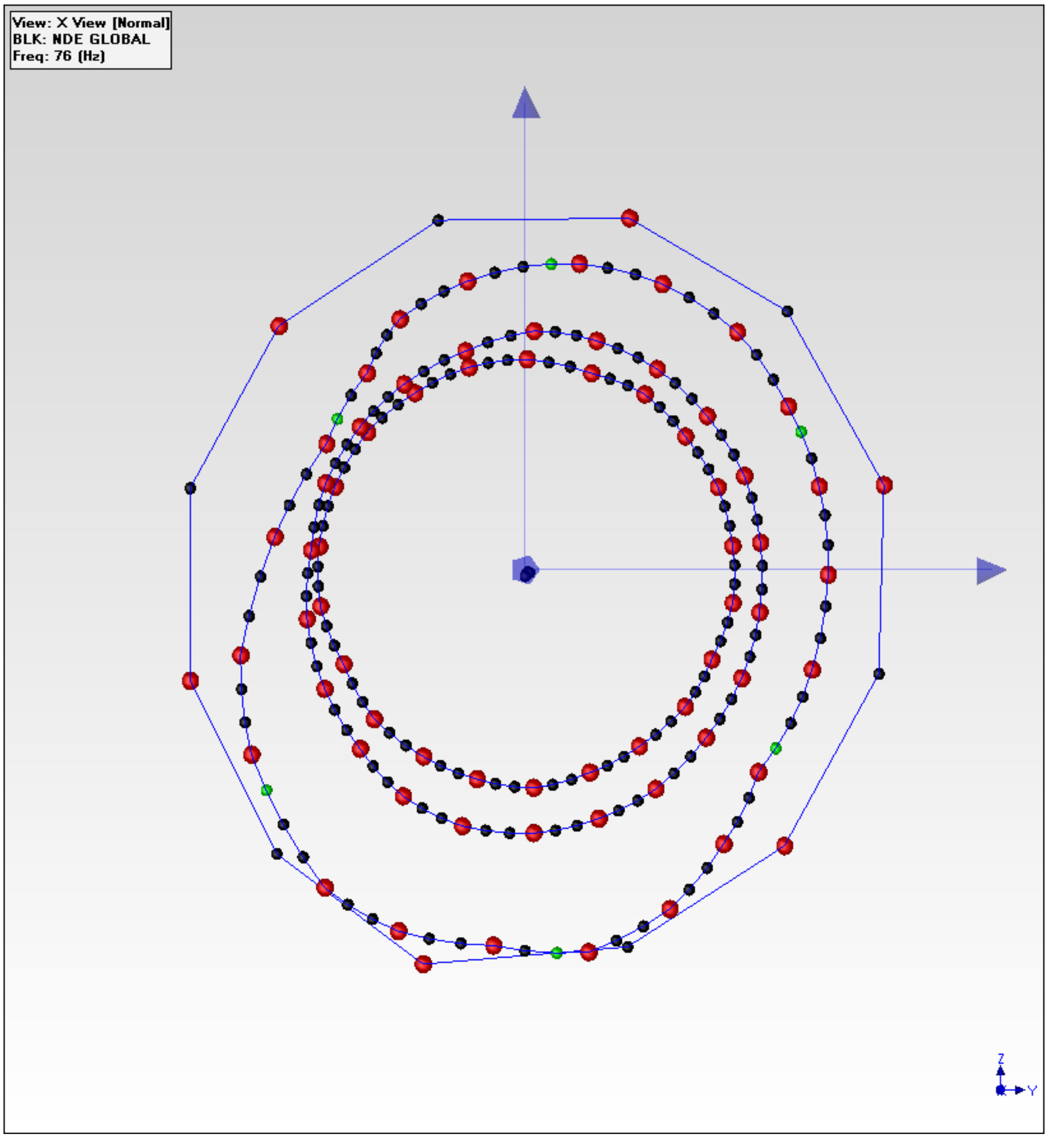


Figure 8-5 NDE mode shape at 82 Hz

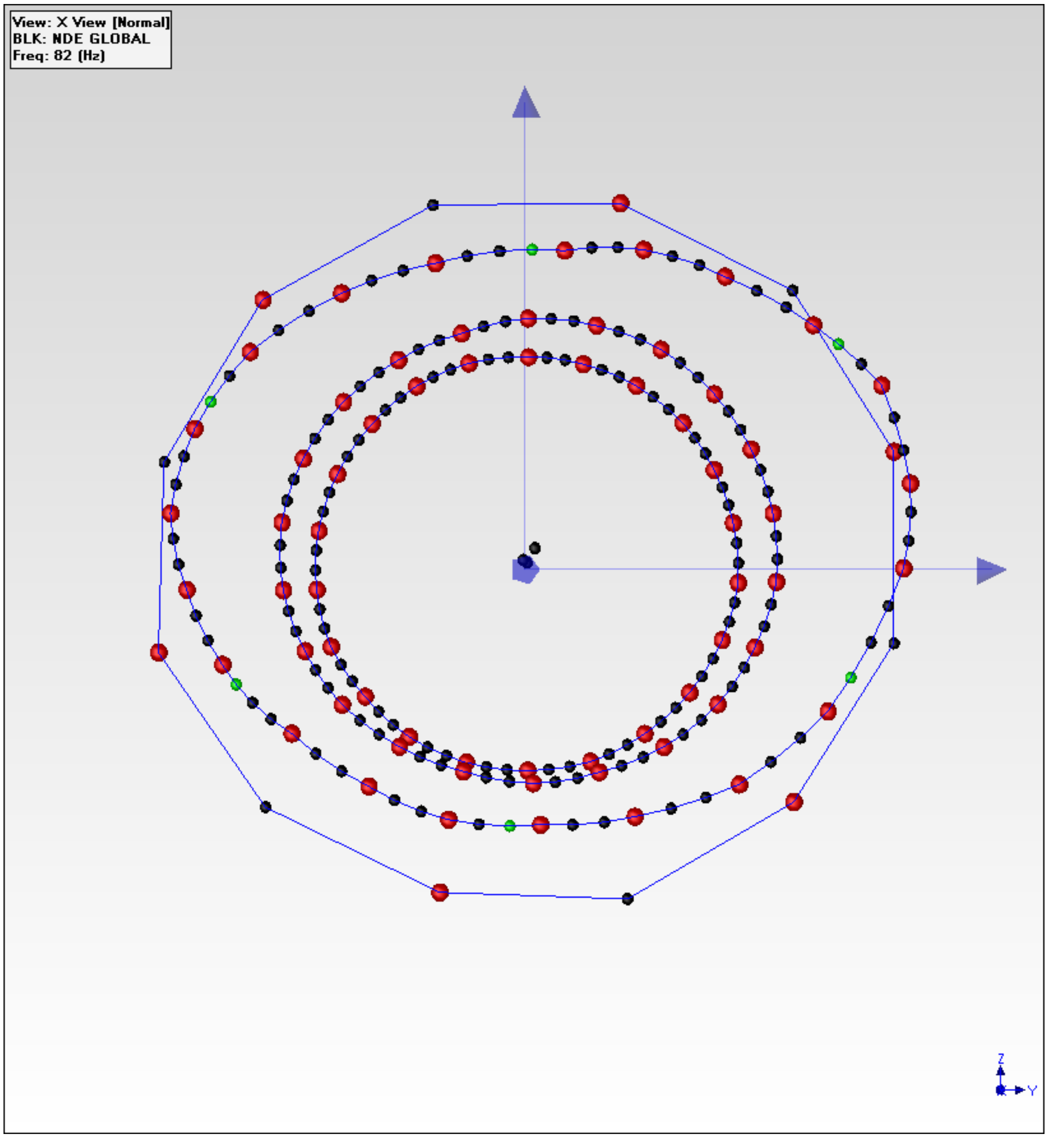


Figure 8-6 NDE mode shape at 93.5 Hz

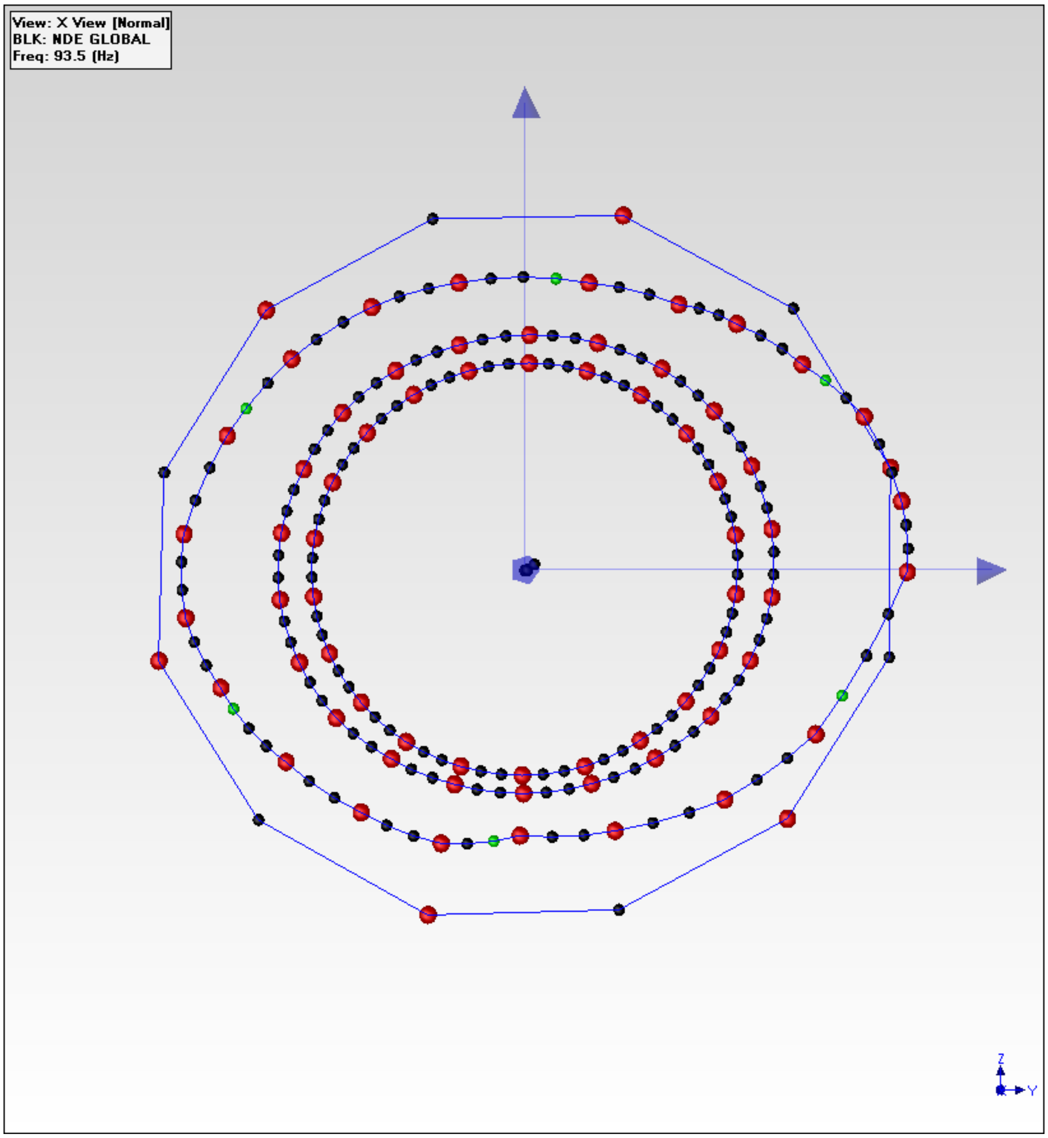


Figure 8-7 NDE mode shape at 105 Hz

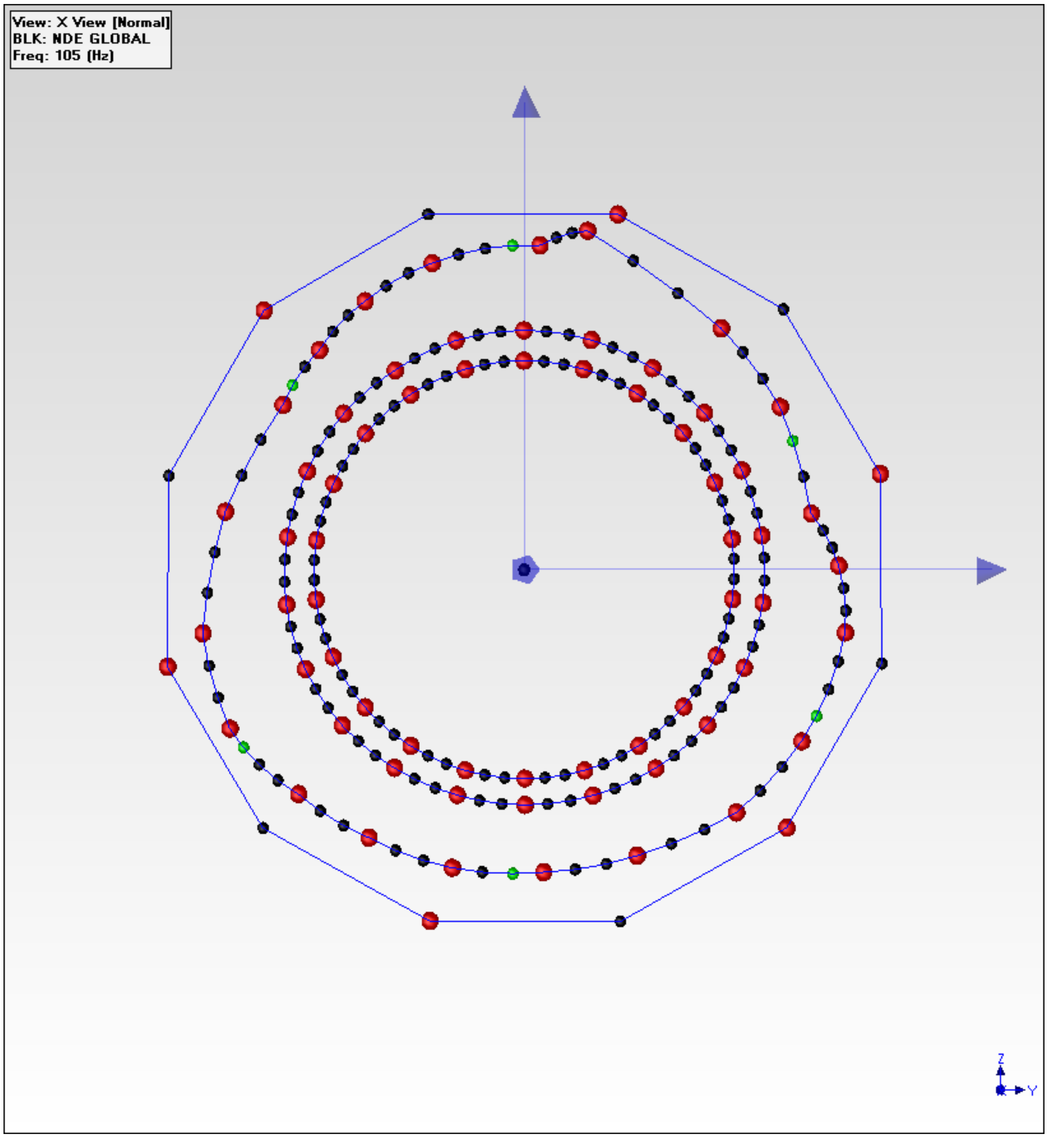
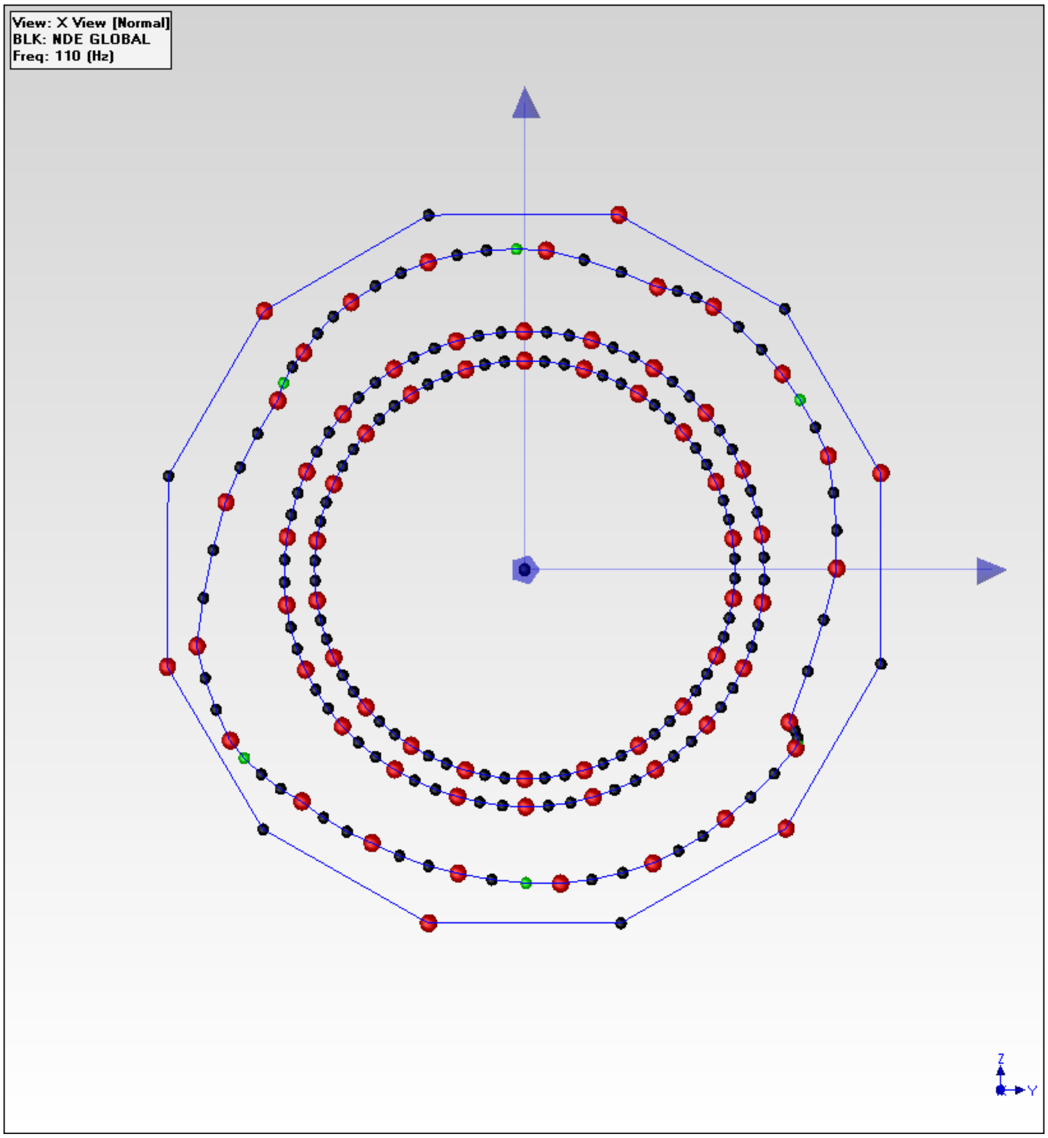


Figure 8-8 NDE mode shape at 110 Hz



NDE Driving Point Measurements of Series Caps

The driving point measurements of the series caps were performed by impacting each cap and measuring the vibrations on the face of the corresponding cap. The caps are impacted in the radial direction while measuring the vibrations in the radial, tangential, and axial directions. The circumferential locations of the normal caps are shown in figure 9. The results are plotted in figures 10-1 through 10-20. The results in these Figures are plotted from 20 Hz to 200 Hz in the horizontal axis, and from 1E-9 m/N (1 nm/N) to 1E-5 m/N (10000 nm/N) in the vertical axis. As shown in these figures, the magnitudes of vibrations at 120 Hz in the tangential direction for 47 caps are more than 500 nm/N, while for 20 of those caps the magnitudes of vibration is actually more than 1000 nm/N. These magnitudes of vibrations exceed ALSTOM acceptance criterion of 500 nm/N.

Figure 9 Locations of the NDE normal caps around the circumference

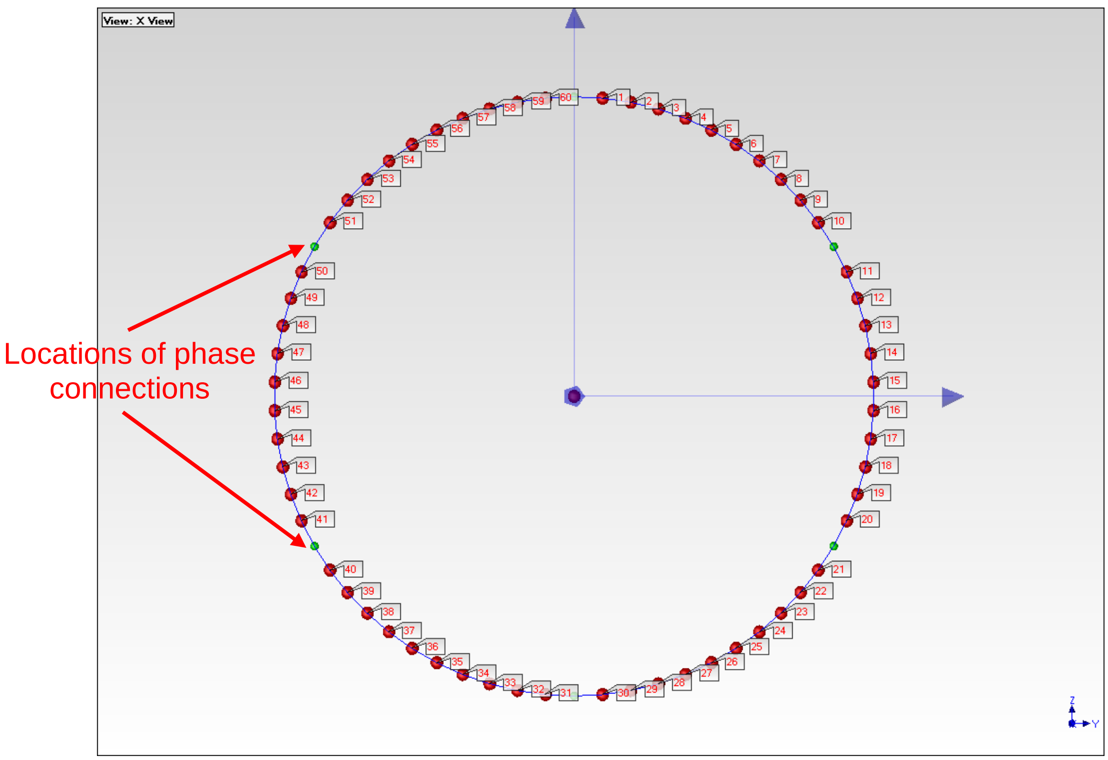


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Figure 10-1 Driving point measurements of NDE SERIES CAPS
Cap numbered 1 (top row), Cap numbered 2 (middle row), and Cap numbered 3 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

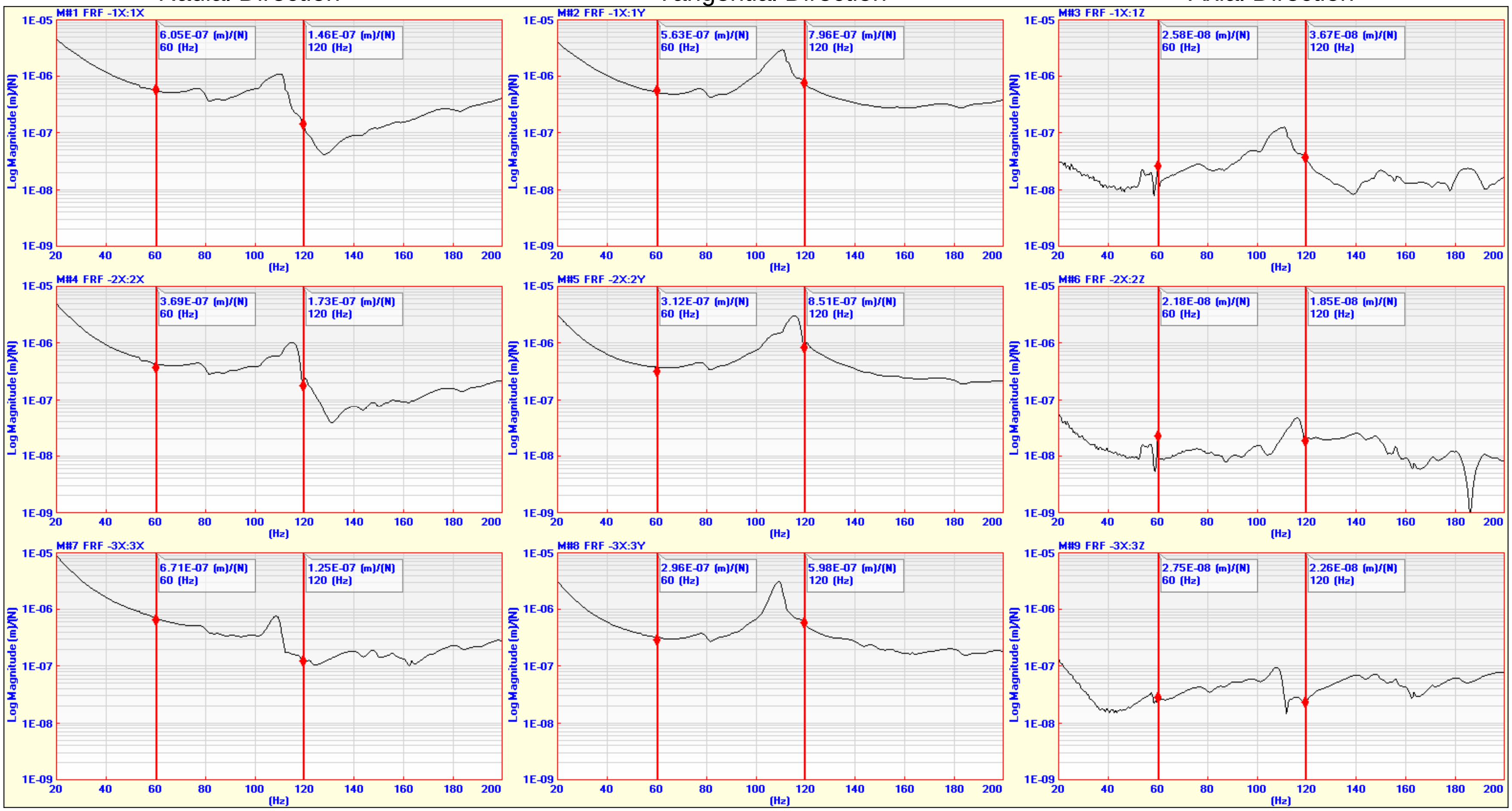

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Figure 10-2 Driving point measurements of NDE SERIES CAPS
Cap numbered 4 (top row), Cap numbered 5 (middle row), and Cap numbered 6 (bottom row)

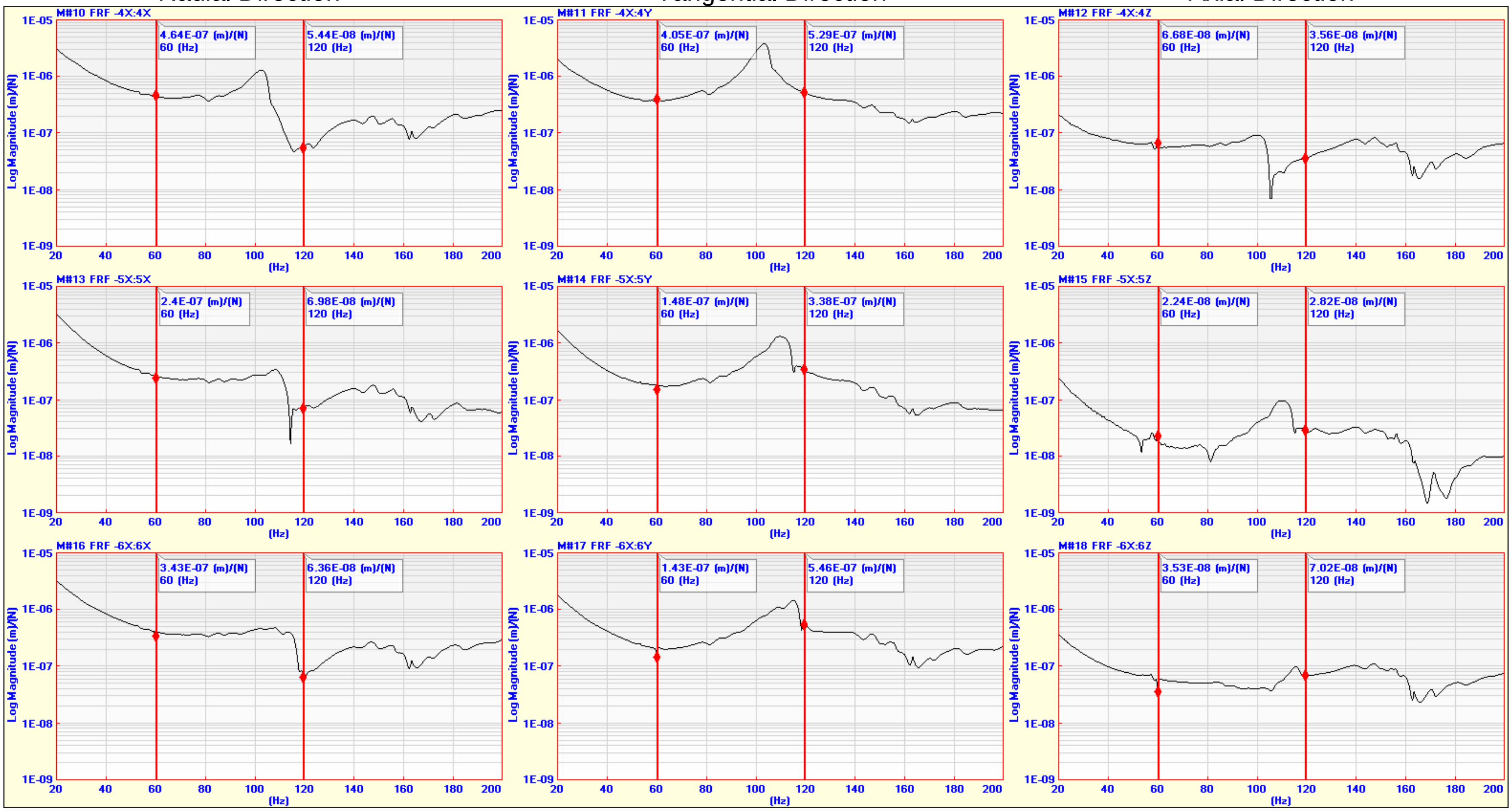

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Figure 10-3 Driving point measurements of NDE SERIES CAPS
Cap numbered 7 (top row), Cap numbered 8 (middle row), and Cap numbered 9 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

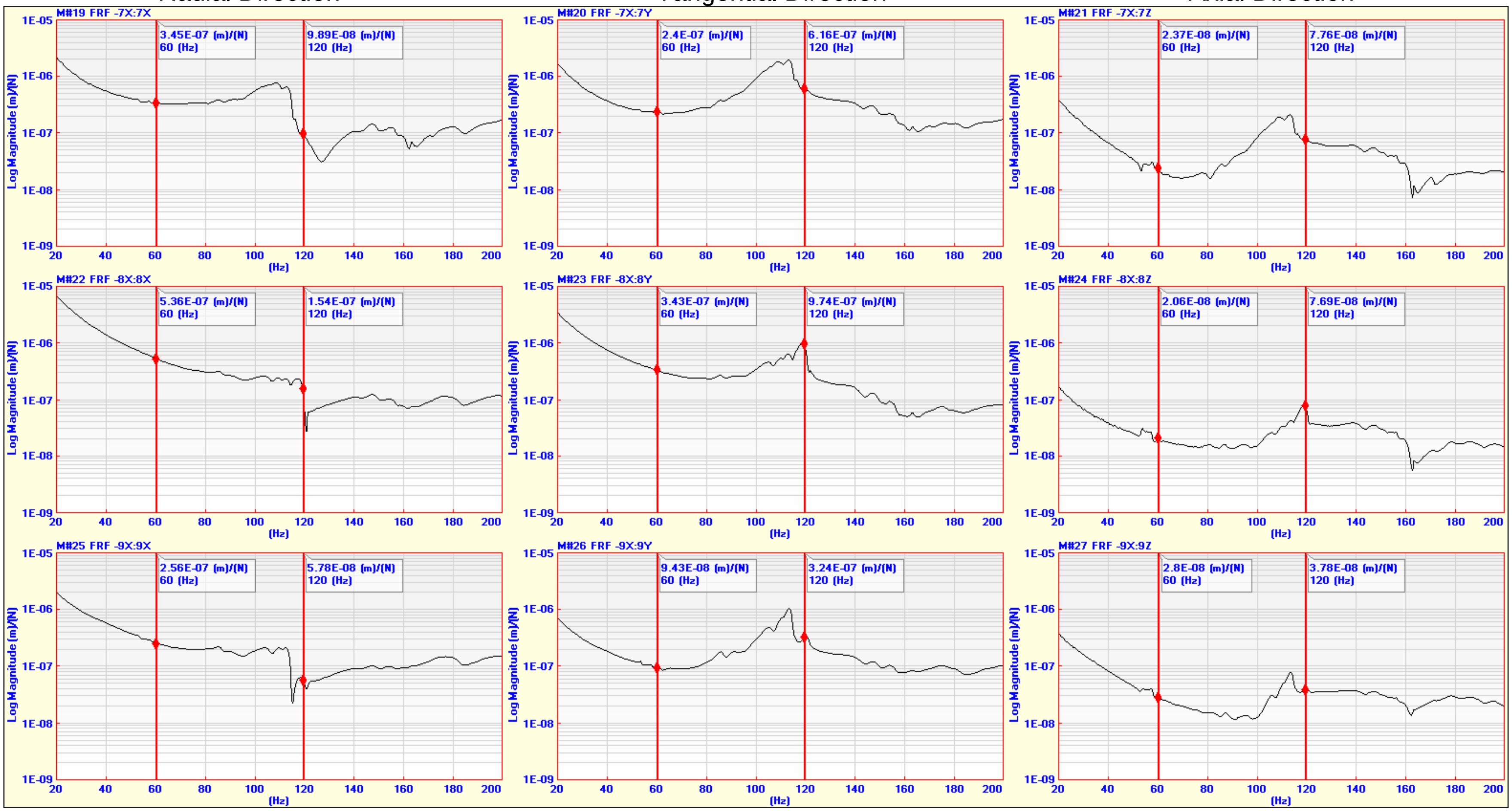

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Figure 10-4 Driving point measurements of NDE SERIES CAPS
Cap numbered 10 (top row), Cap numbered 11 (middle row), and Cap numbered 12 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

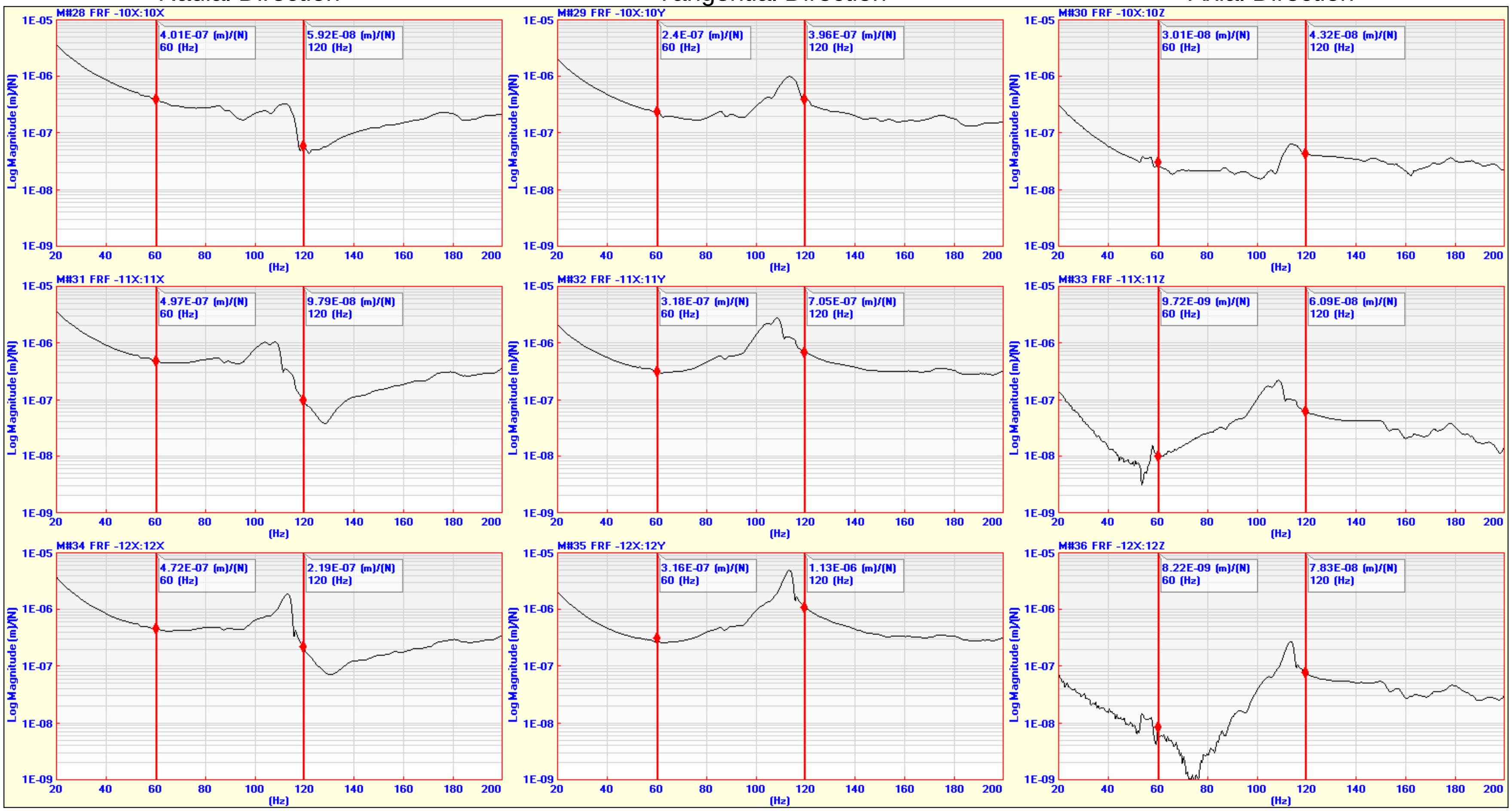

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Figure 10-5 Driving point measurements of NDE SERIES CAPS
Cap numbered 13 (top row), Cap numbered 14 (middle row), and Cap numbered 15 (bottom row)
Radial Direction Tangential Direction Axial Direction

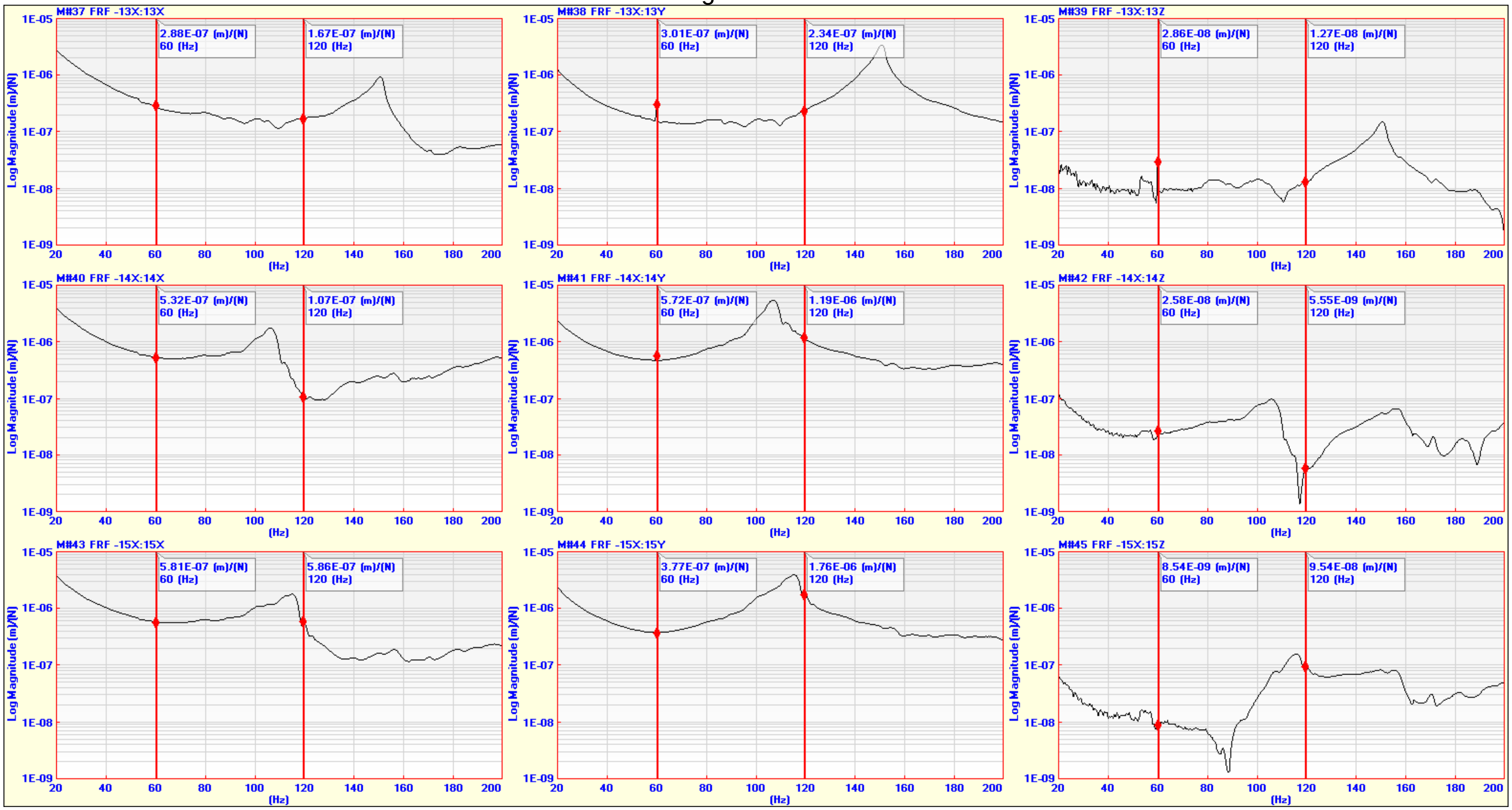

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Figure 10-6 Driving point measurements of NDE SERIES CAPS
Cap numbered 16 (top row), Cap numbered 17 (middle row), and Cap numbered 18 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

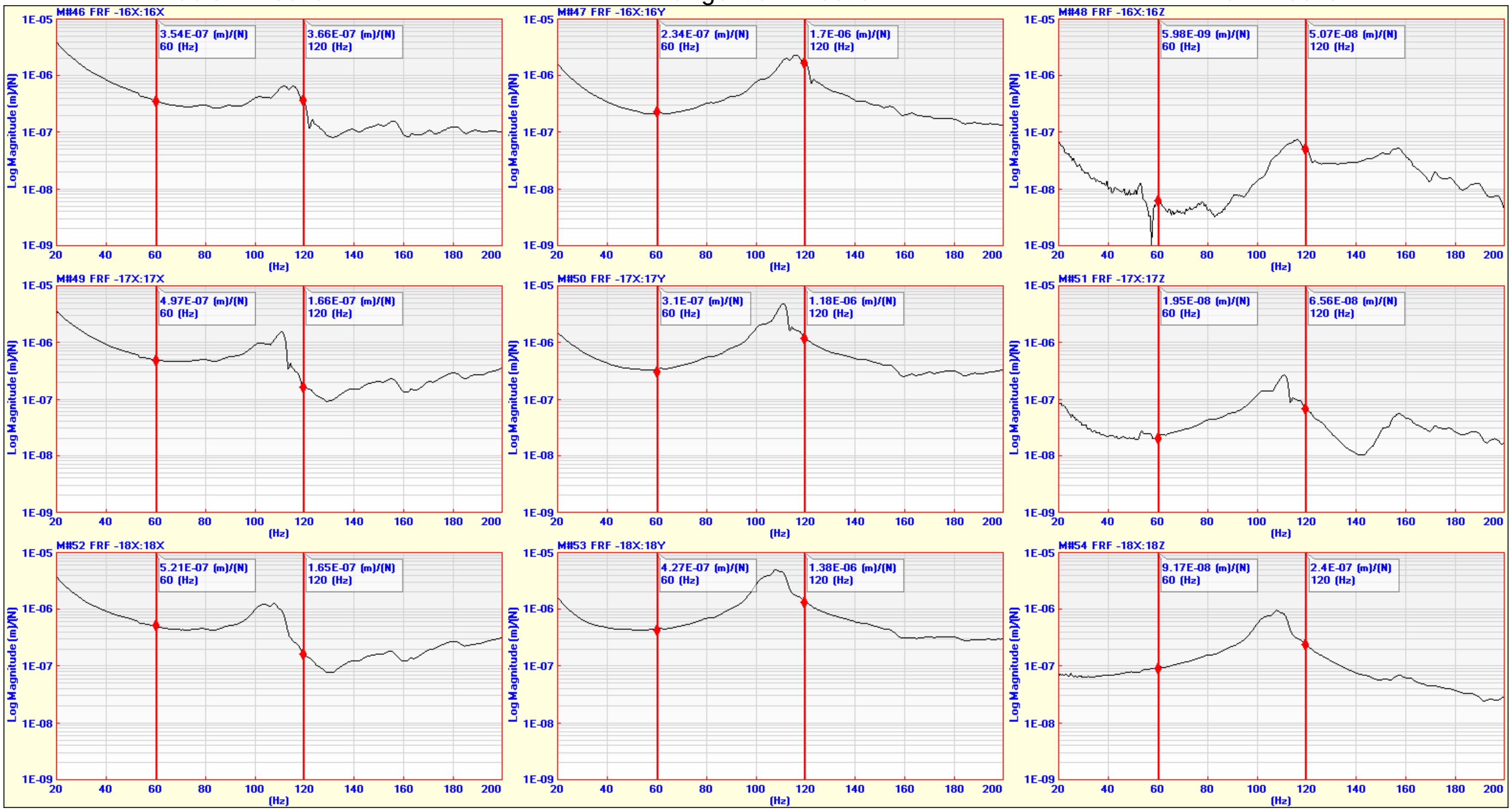

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Figure 10-7 Driving point measurements of NDE SERIES CAPS
Cap numbered 19 (top row), Cap numbered 20 (middle row), and Cap numbered 21 (bottom row)

Radial Direction Tangential Direction Axial Direction

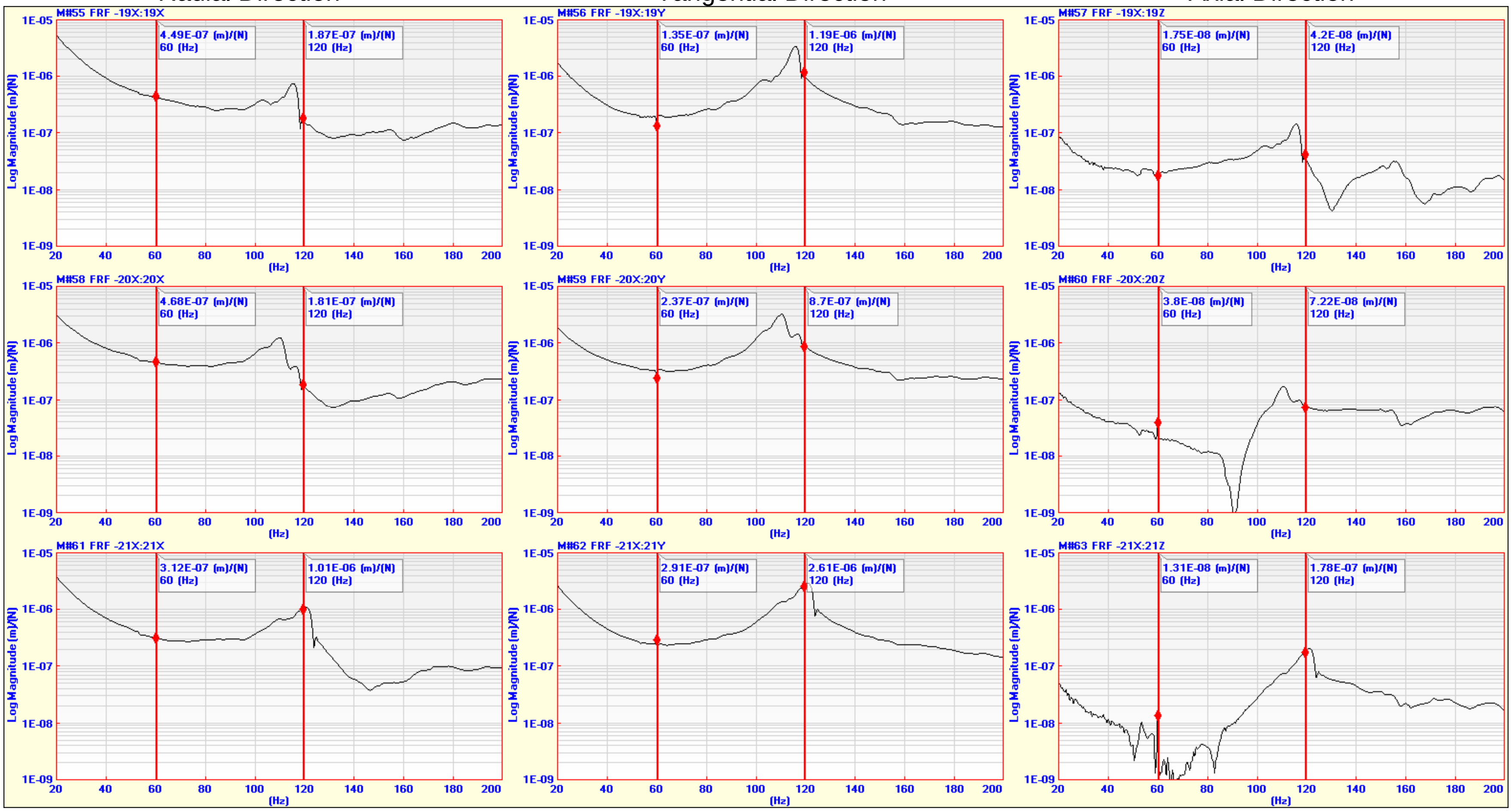

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Figure 10-8 Driving point measurements of NDE SERIES CAPS
Cap numbered 22 (top row), Cap numbered 23 (middle row), and Cap numbered 24 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

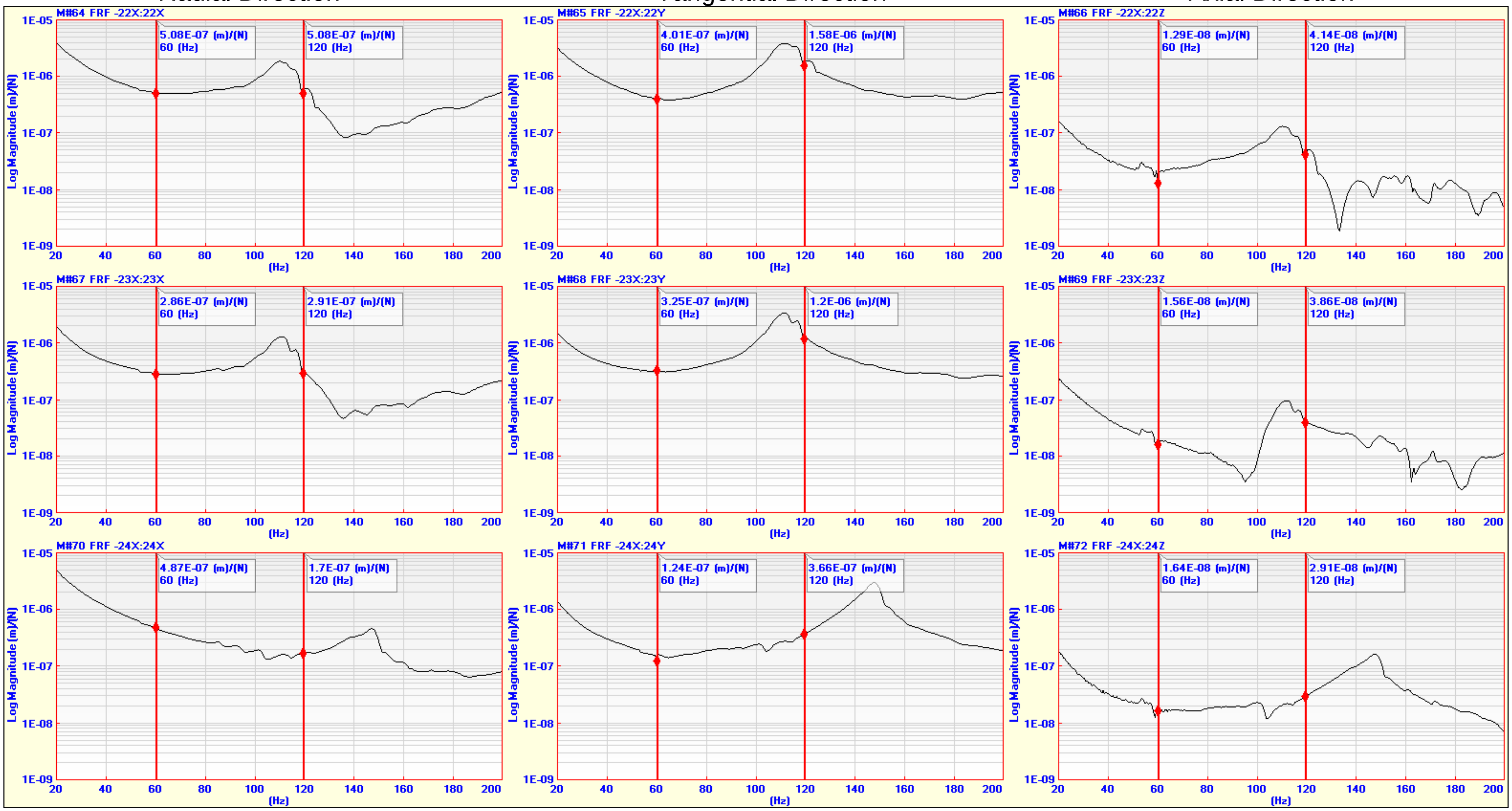

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Figure 10-9 Driving point measurements of NDE SERIES CAPS
Cap numbered 25 (top row), Cap numbered 26 (middle row), and Cap numbered 27 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

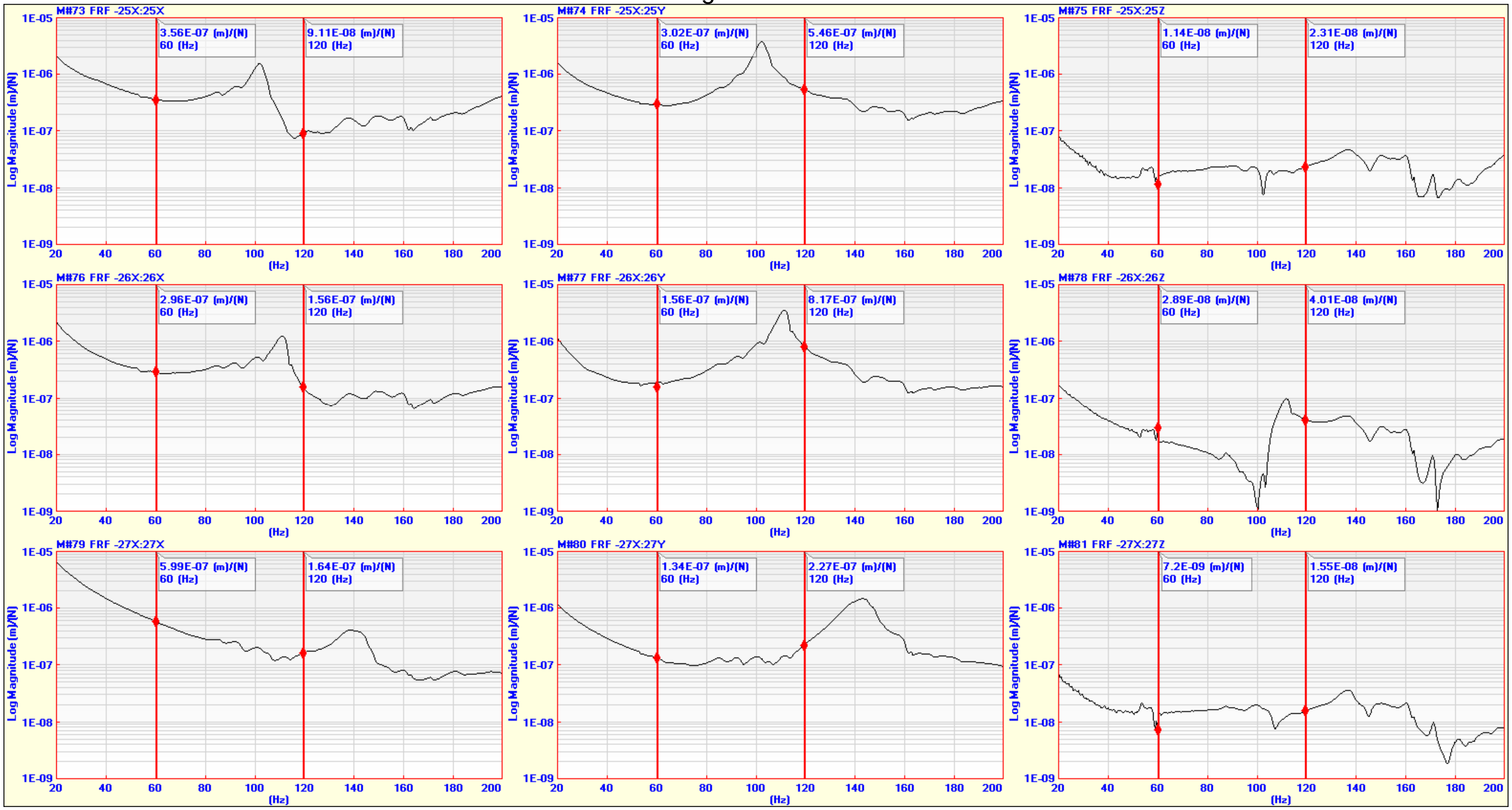

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Figure 10-10 Driving point measurements of NDE SERIES CAPS
Cap numbered 28 (top row), Cap numbered 29 (middle row), and Cap numbered 30 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

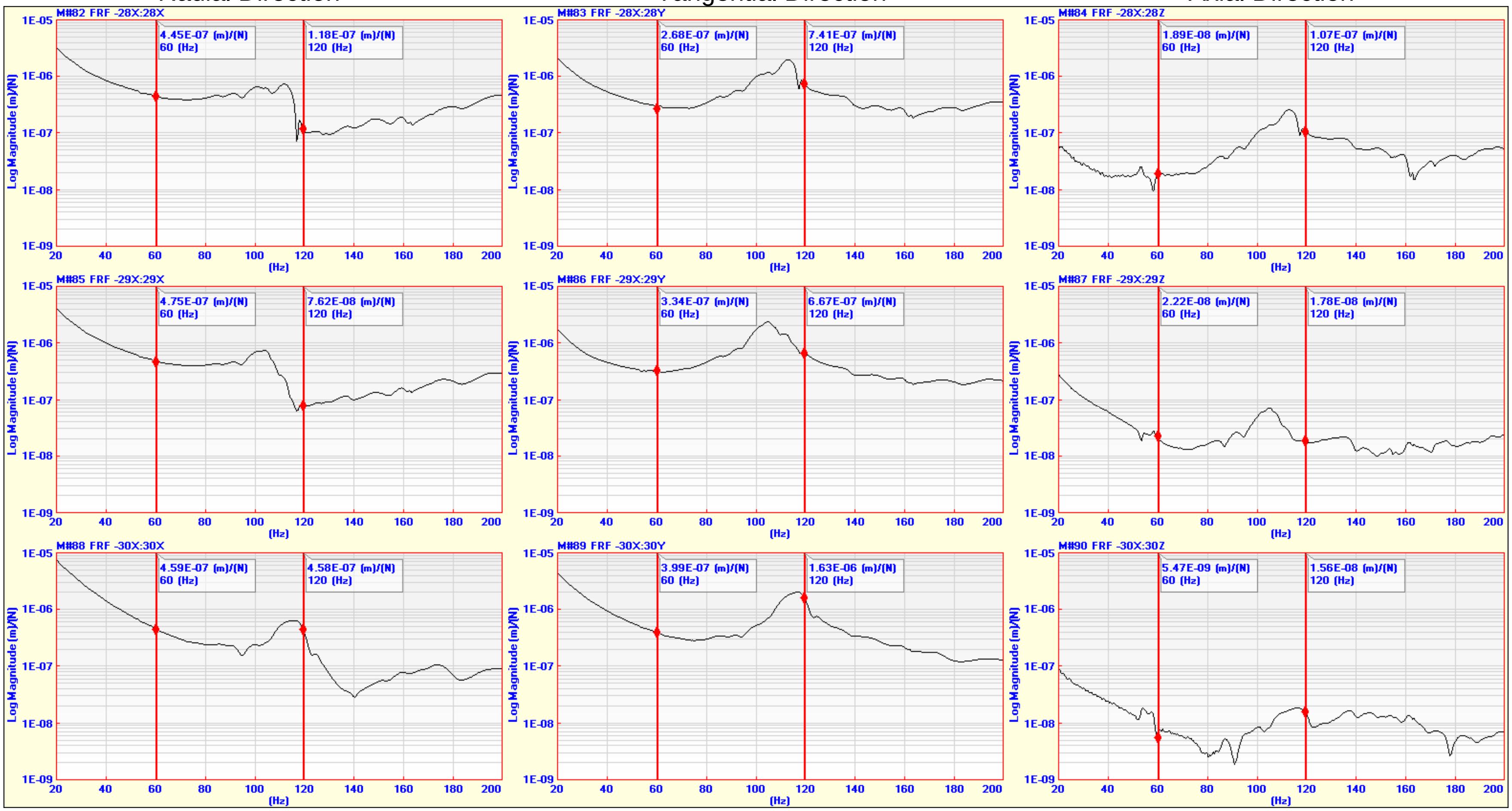

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Figure 10-11 Driving point measurements of NDE SERIES CAPS
Cap numbered 31 (top row), Cap numbered 32 (middle row), and Cap numbered 33 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

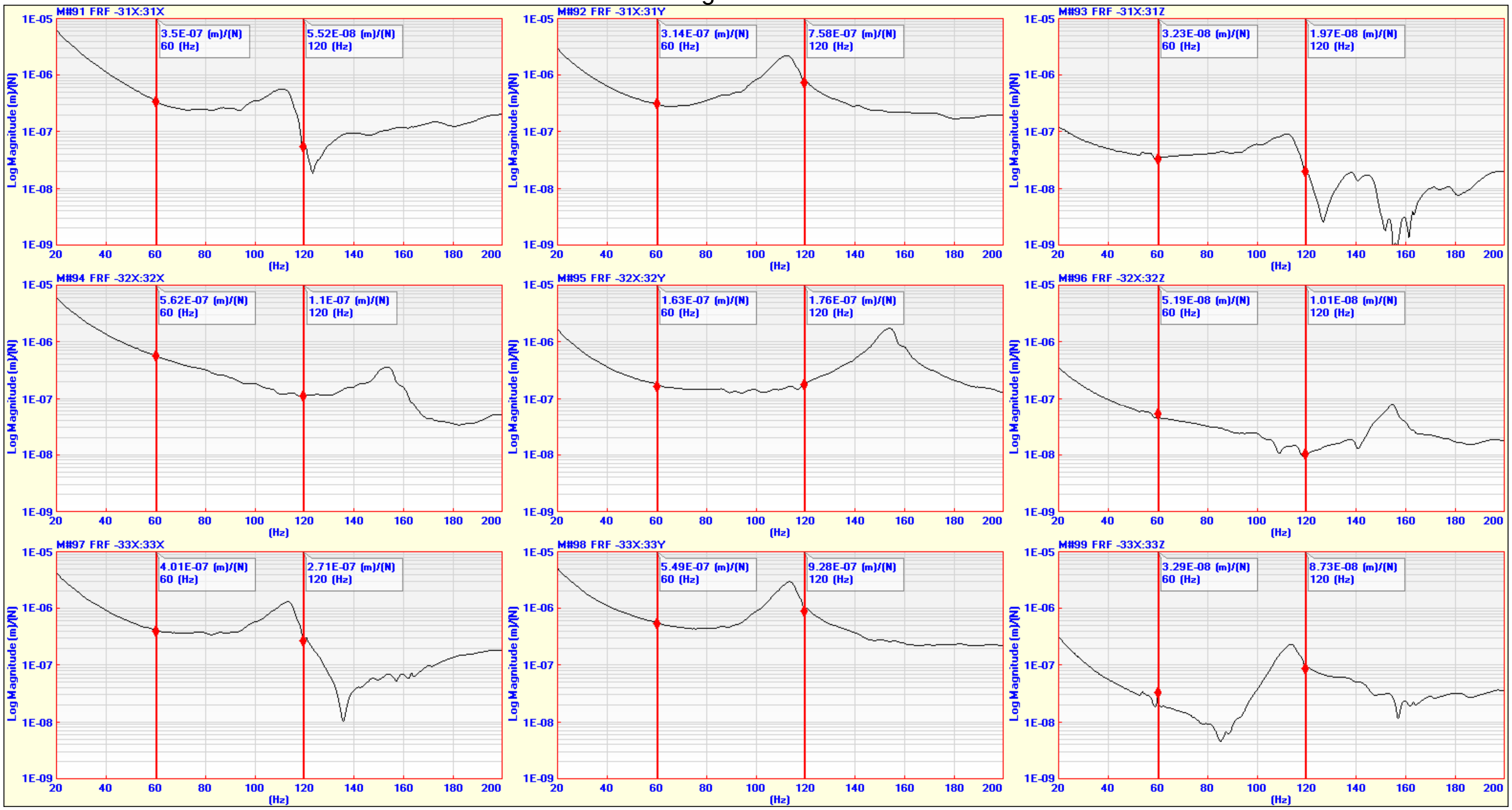

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Figure 10-12 Driving point measurements of NDE SERIES CAPS
Cap numbered 34 (top row), Cap numbered 35 (middle row), and Cap numbered 36 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

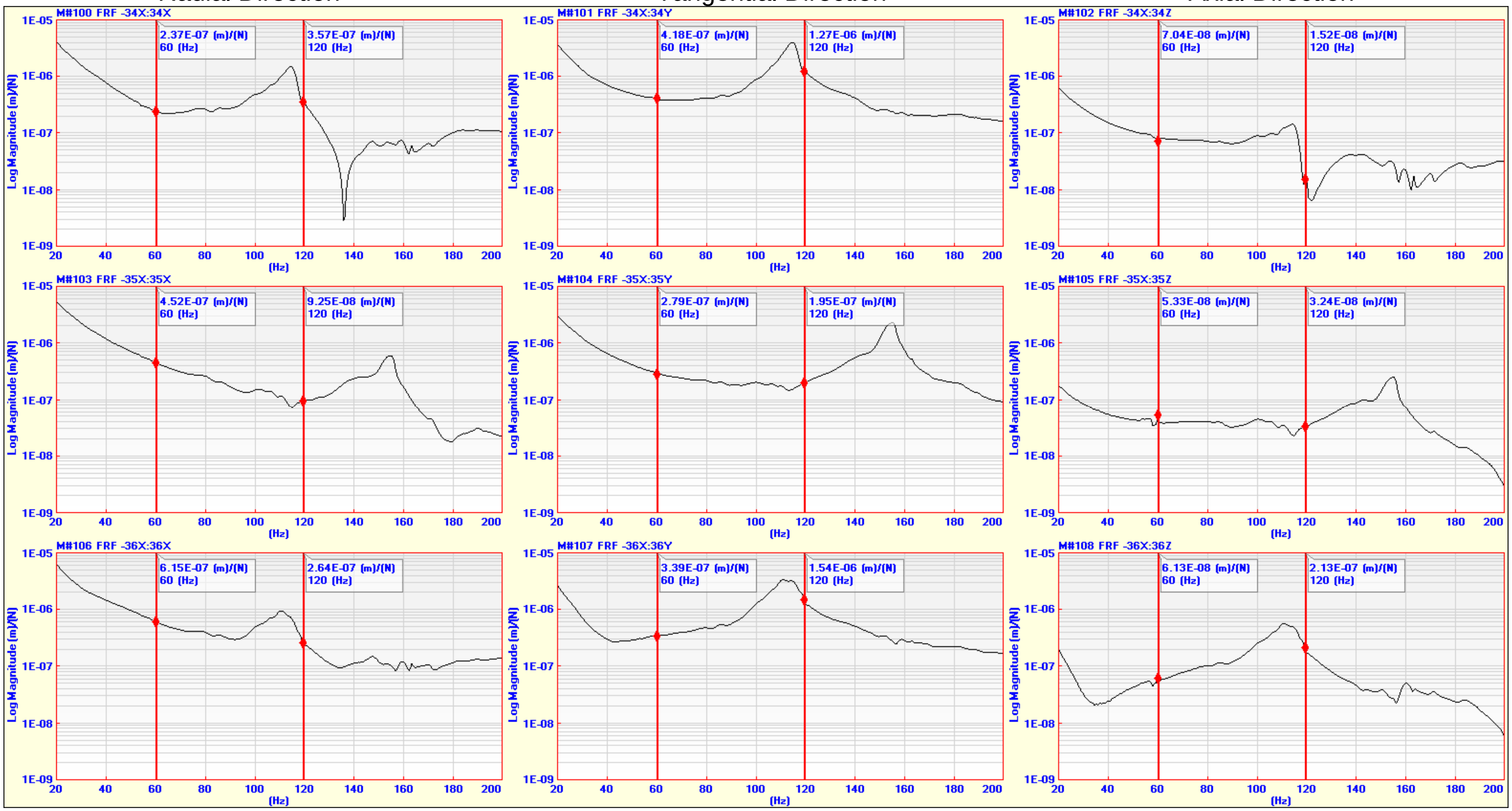

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Figure 10-13 Driving point measurements of NDE SERIES CAPS
Cap numbered 37 (top row), Cap numbered 38 (middle row), and Cap numbered 39 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

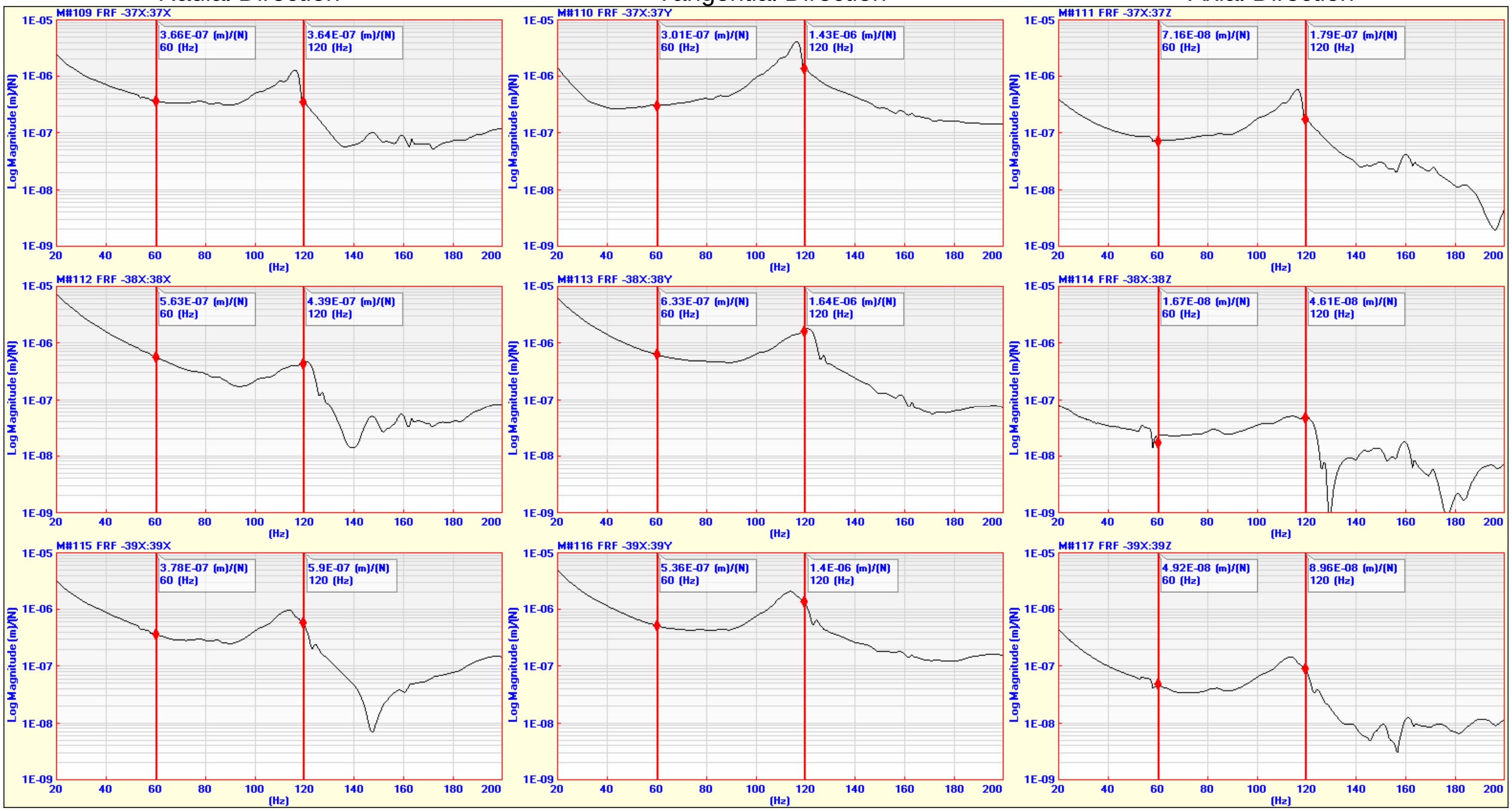

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Figure 10-14 Driving point measurements of NDE SERIES CAPS
Cap numbered 40 (top row), Cap numbered 41 (middle row), and Cap numbered 42 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

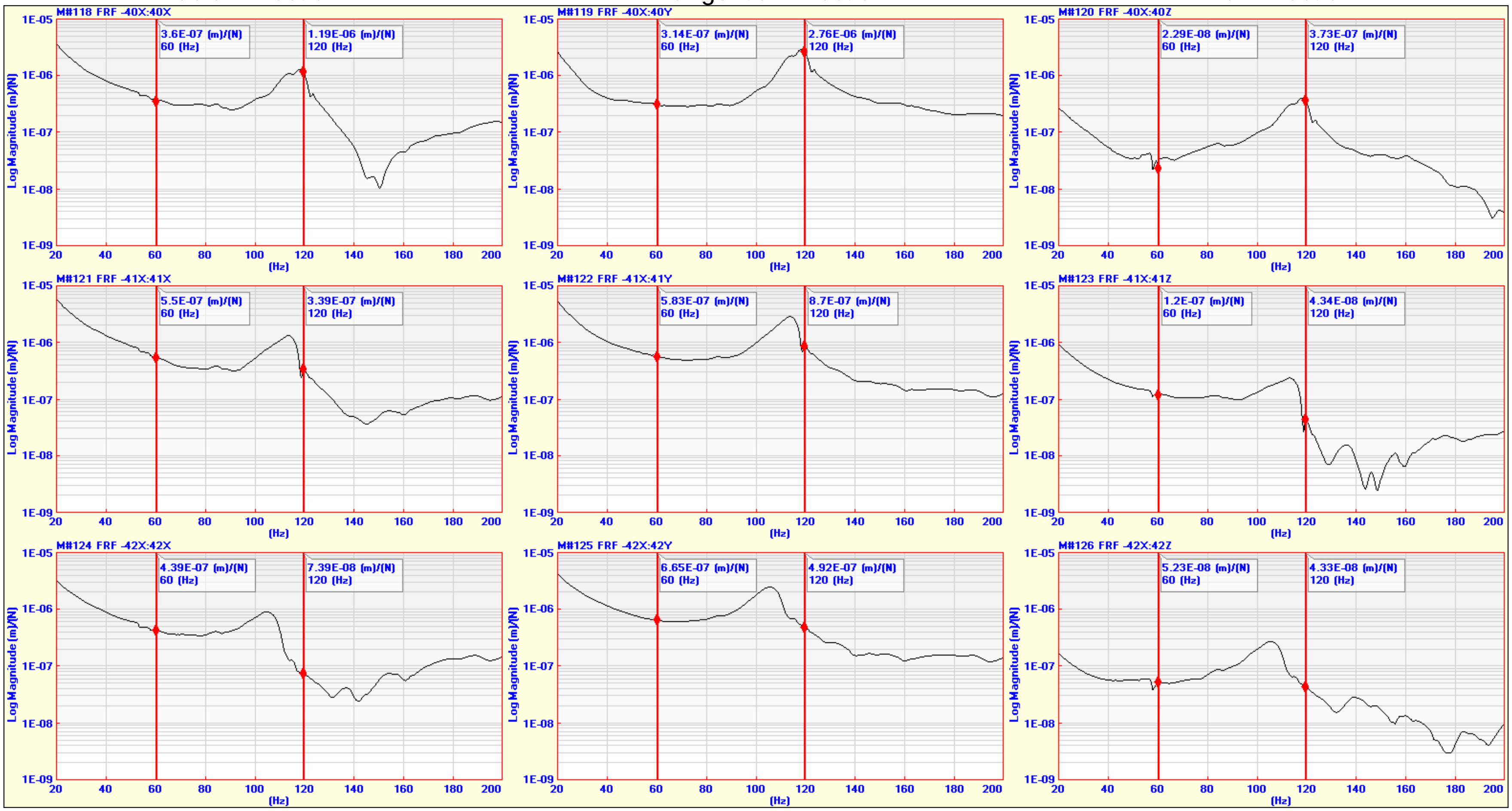

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Figure 10-15 Driving point measurements of NDE SERIES CAPS
Cap numbered 43 (top row), Cap numbered 44 (middle row), and Cap numbered 45 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

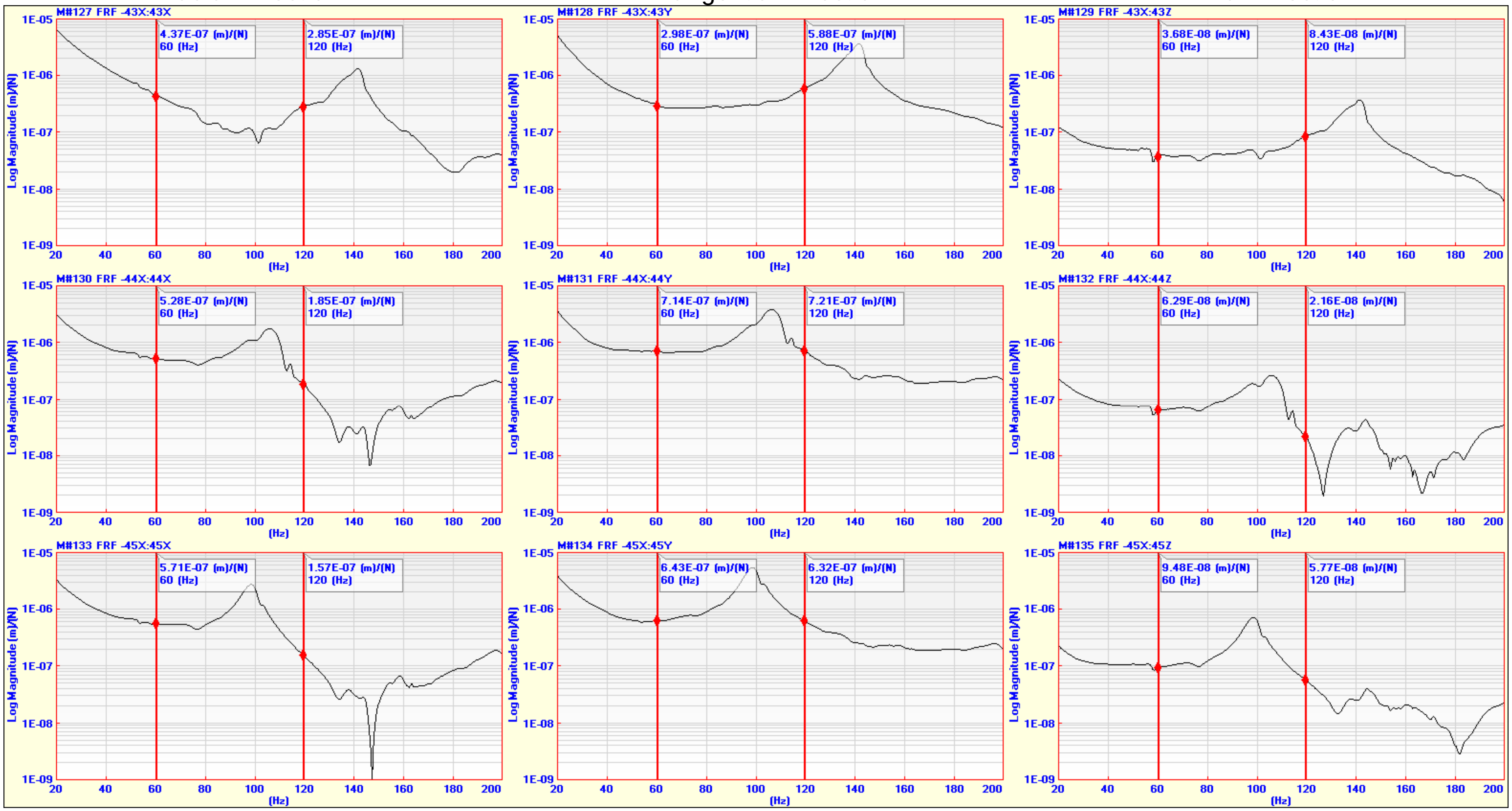

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Figure 10-16 Driving point measurements of NDE SERIES CAPS
Cap numbered 46 (top row), Cap numbered 47 (middle row), and Cap numbered 48 (bottom row)

Radial Direction Tangential Direction Axial Direction

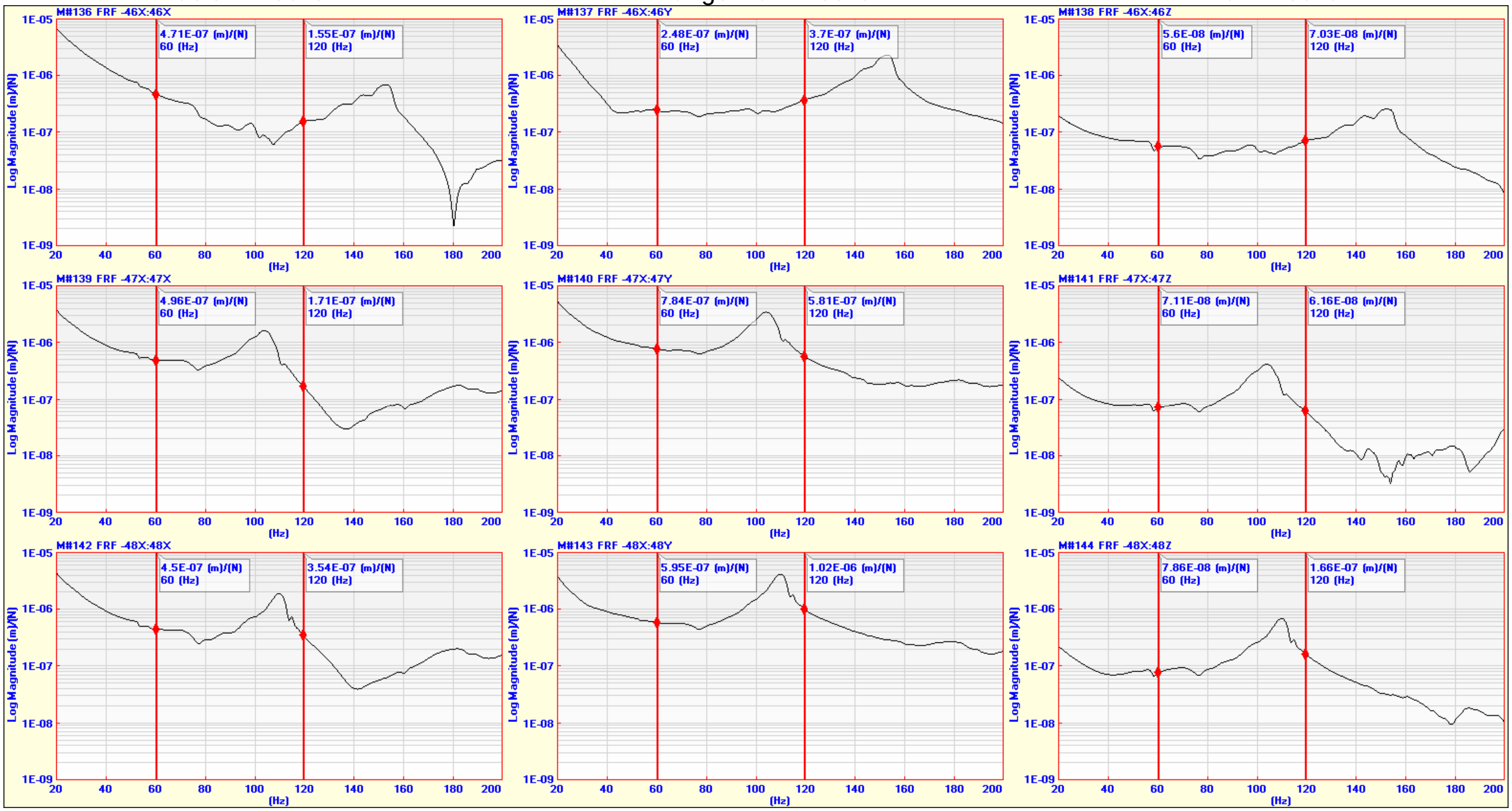

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Figure 10-17 Driving point measurements of NDE SERIES CAPS
Cap numbered 49 (top row), Cap numbered 50 (middle row), and Cap numbered 51 (bottom row)

Radial Direction Tangential Direction Axial Direction

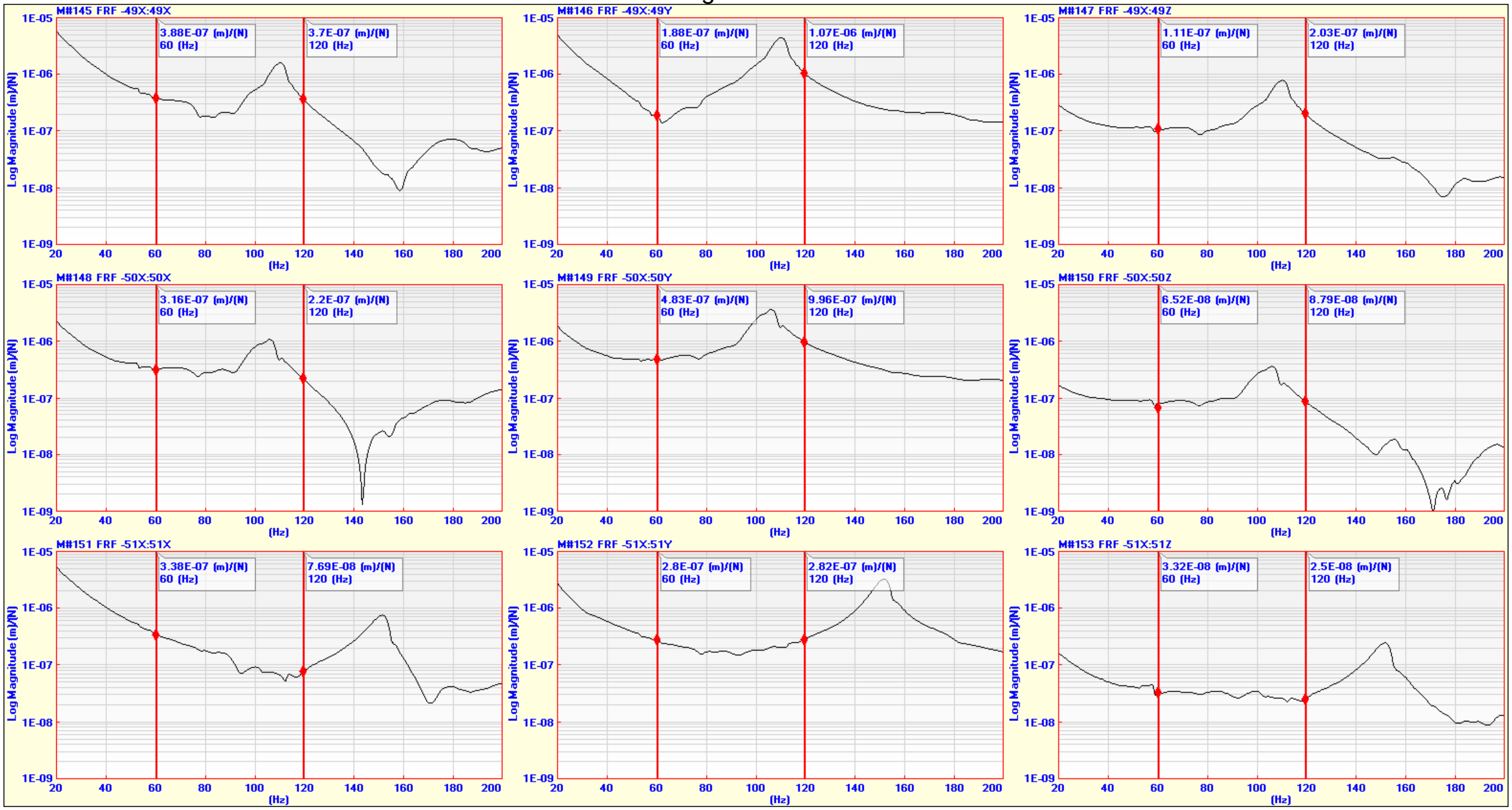

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Figure 10-18 Driving point measurements of NDE SERIES CAPS
Cap numbered 52 (top row), Cap numbered 53 (middle row), and Cap numbered 54 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

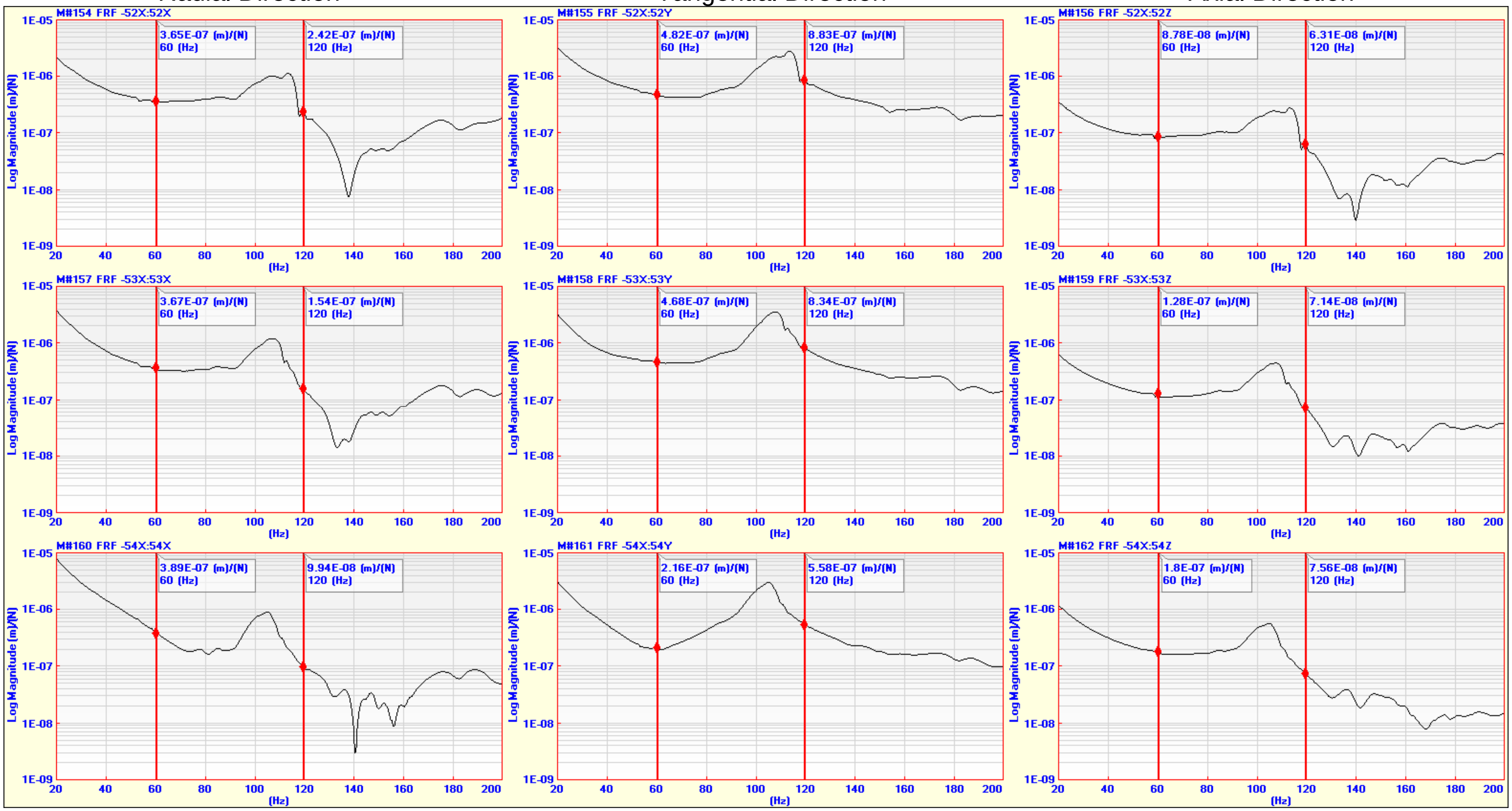

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Figure 10-19 Driving point measurements of NDE SERIES CAPS
Cap numbered 55 (top row), Cap numbered 56 (middle row), and Cap numbered 57 (bottom row)

Radial Direction   Tangential Direction   Axial Direction

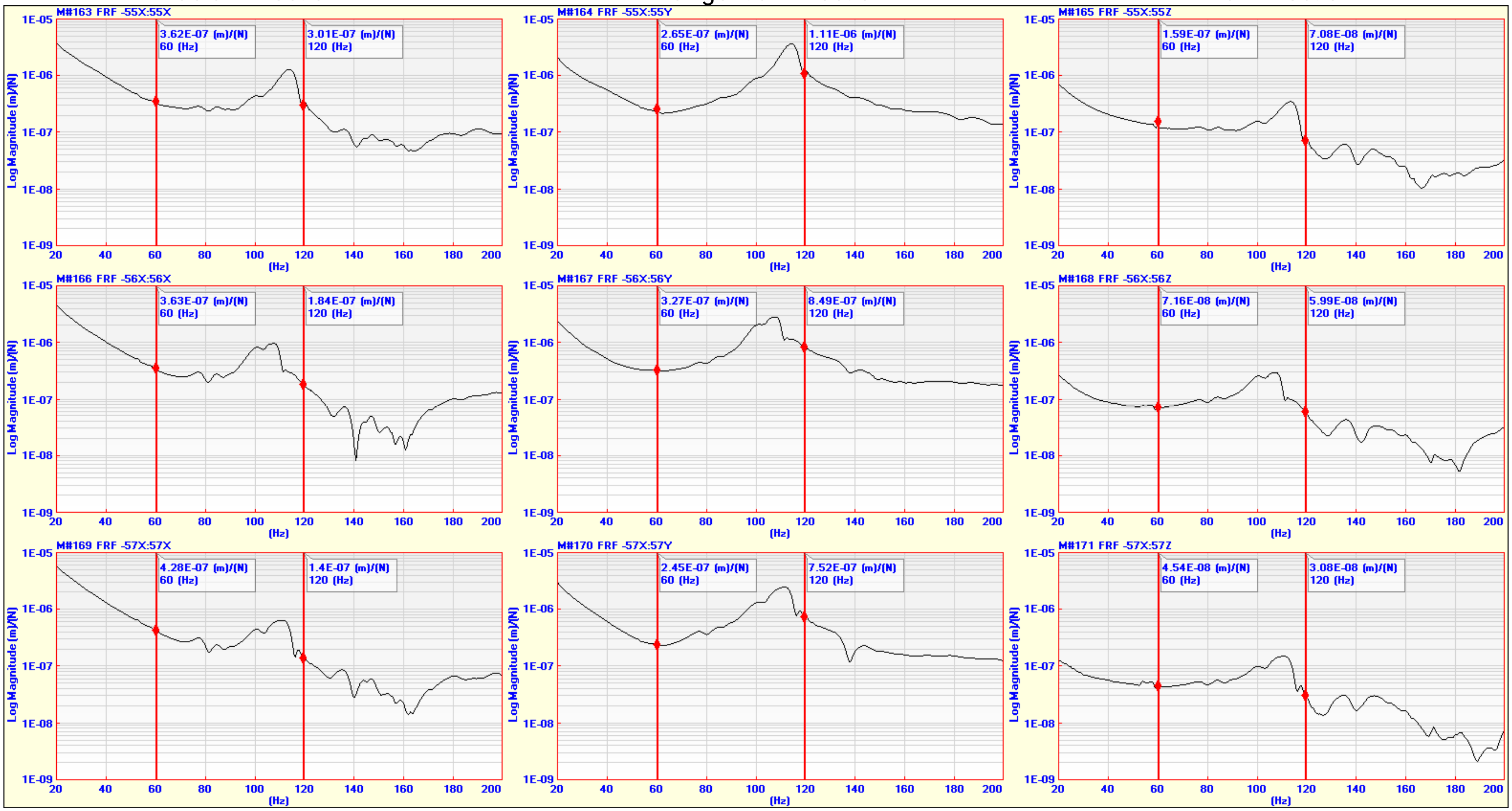

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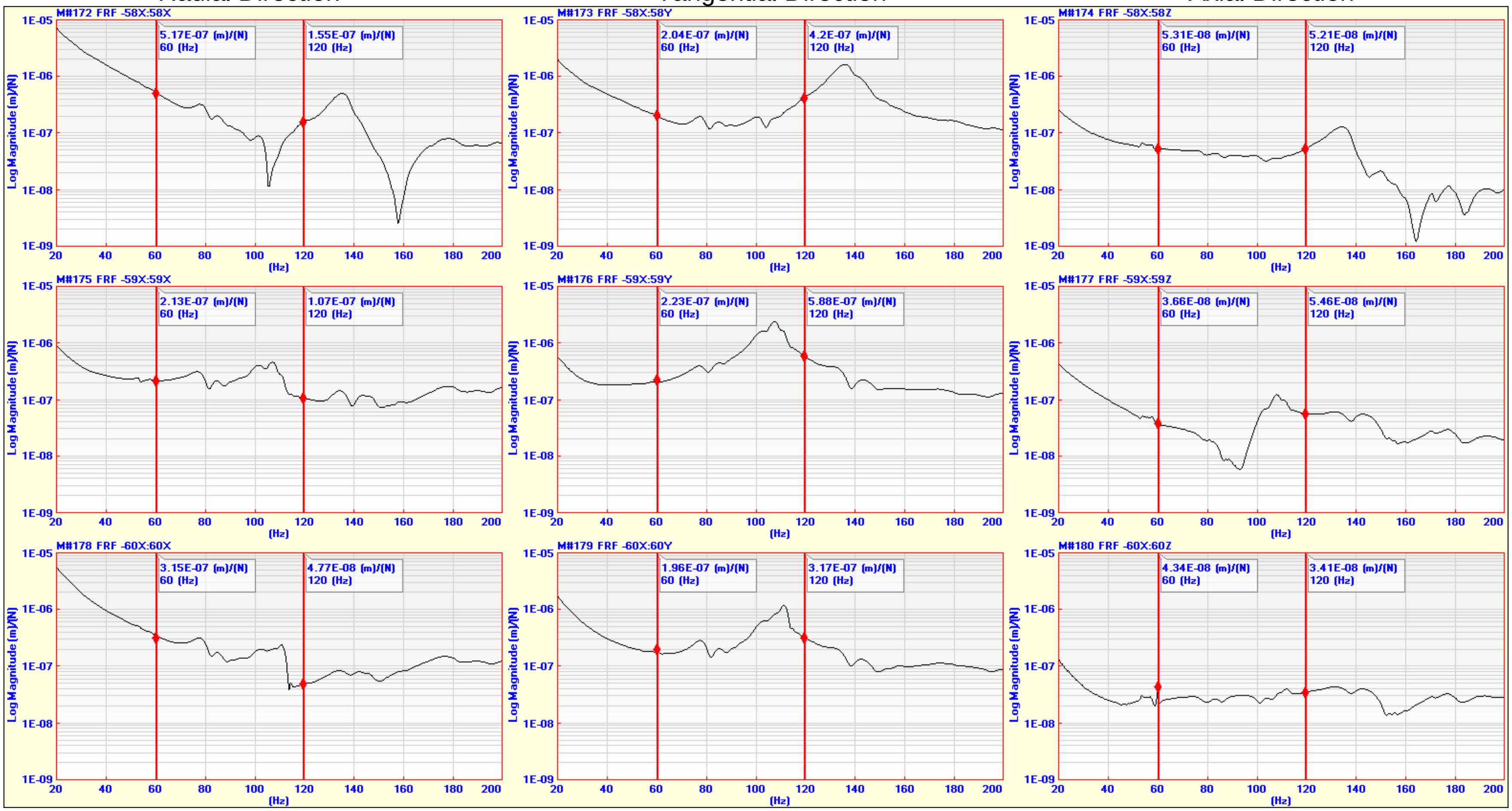
Figure 10-20 Driving point measurements of NDE SERIES CAPS
Cap numbered 58 (top row), Cap numbered 59 (middle row), and Cap numbered 60 (bottom row)

Radial Direction   Tangential Direction   Axial Direction



NDE Driving Point Measurements of Phase Connection

The driving point measurements of the phase connections (PC) were performed by impacting at the vicinity of each measurement point on the connection in radial, tangential, and axial directions and measuring the vibrations at point A, and at point B on the arm of the phase connection after the first bend. The numbering of each phase connection and the measuring points are shown in figure 11-1, and the locations of the accelerometer on a typical phase connection cap and arm are shown in Figure 11-2. The results are plotted in figures 12-1 through 12-12. As shown in these figures, the magnitudes of vibrations in the tangential directions for points A and B are relatively high and exceed ALSTOM acceptance criterion.

Figure 11-1 Numbering of each phase connection

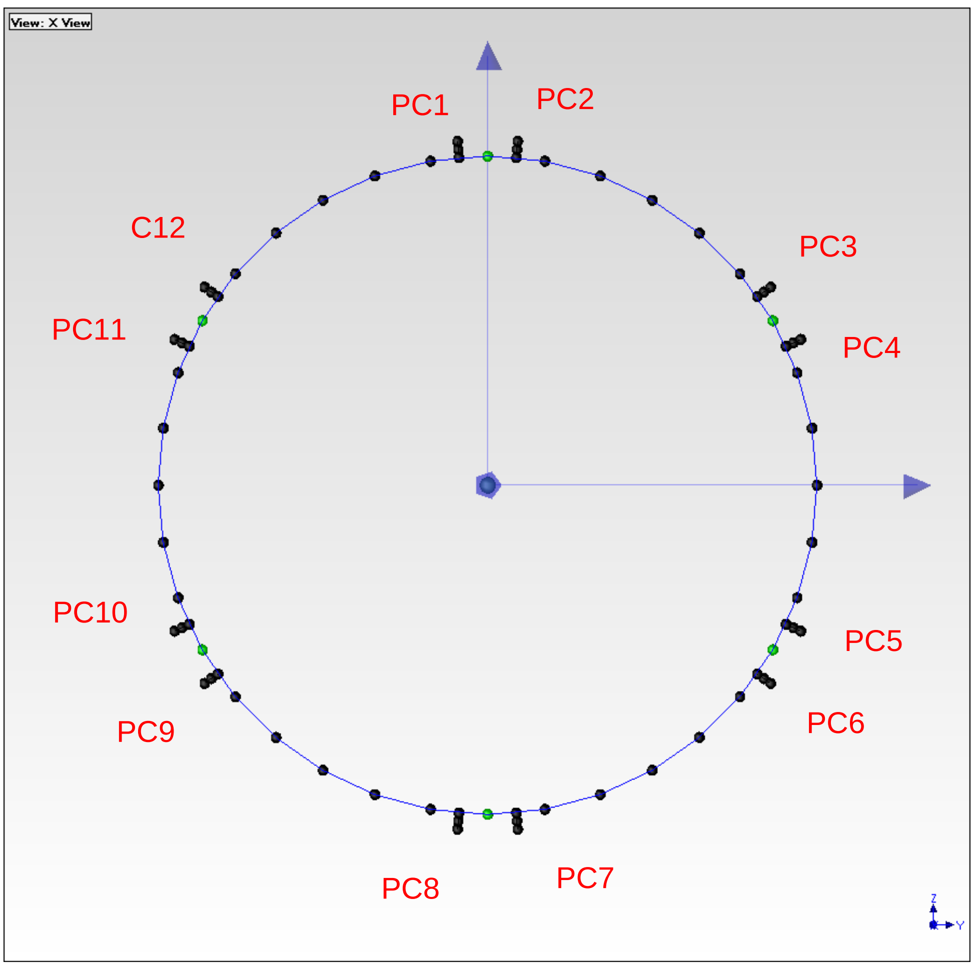


Figure 11-2 Accelerometer locations on typical phase connection (point A) and corresponding Arm (point B)

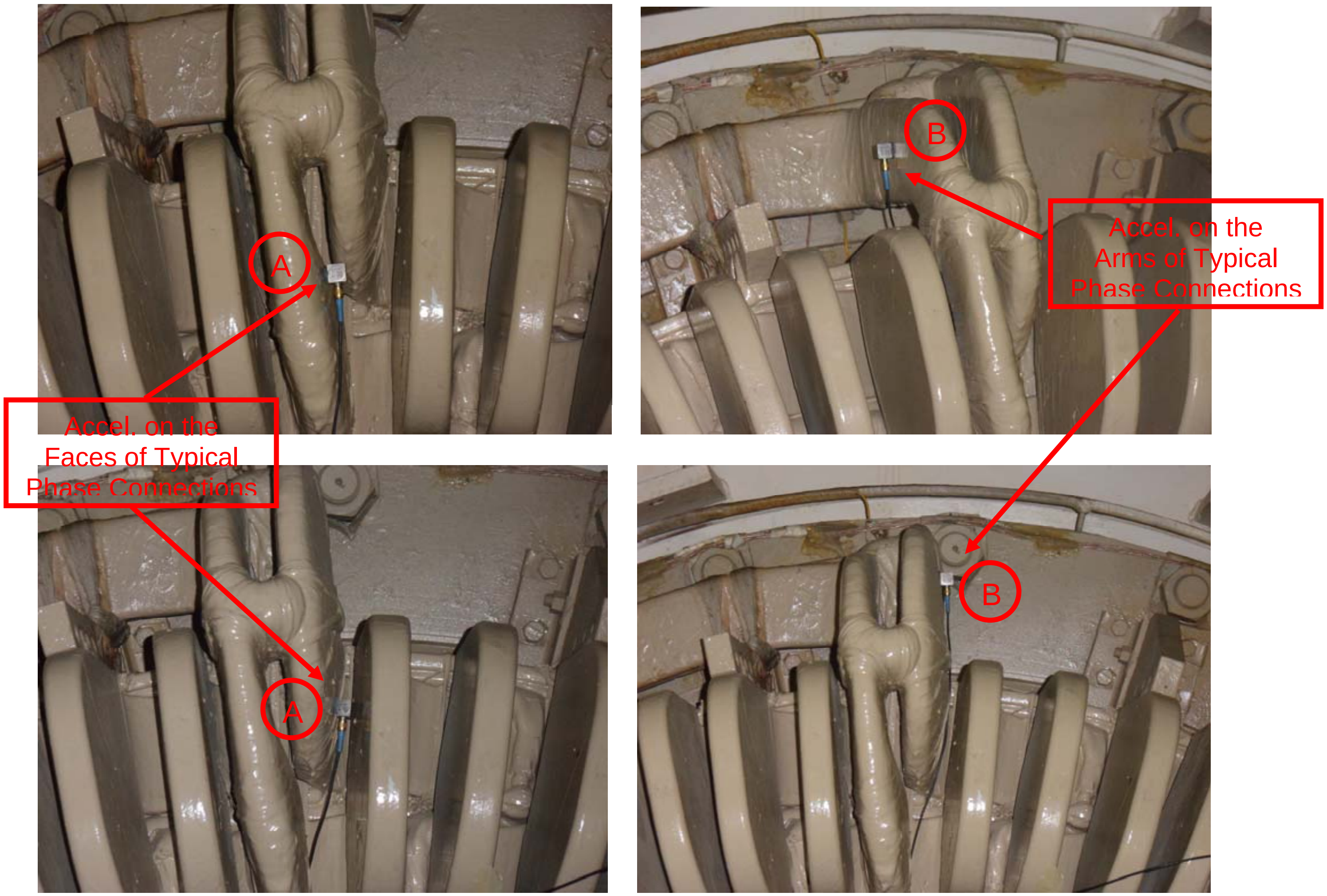


Figure 12-1 Driving point measurements of PC1
Point A (top row), and point B (bottom row)

Radial Direction | Tangential Direction | Axial Direction

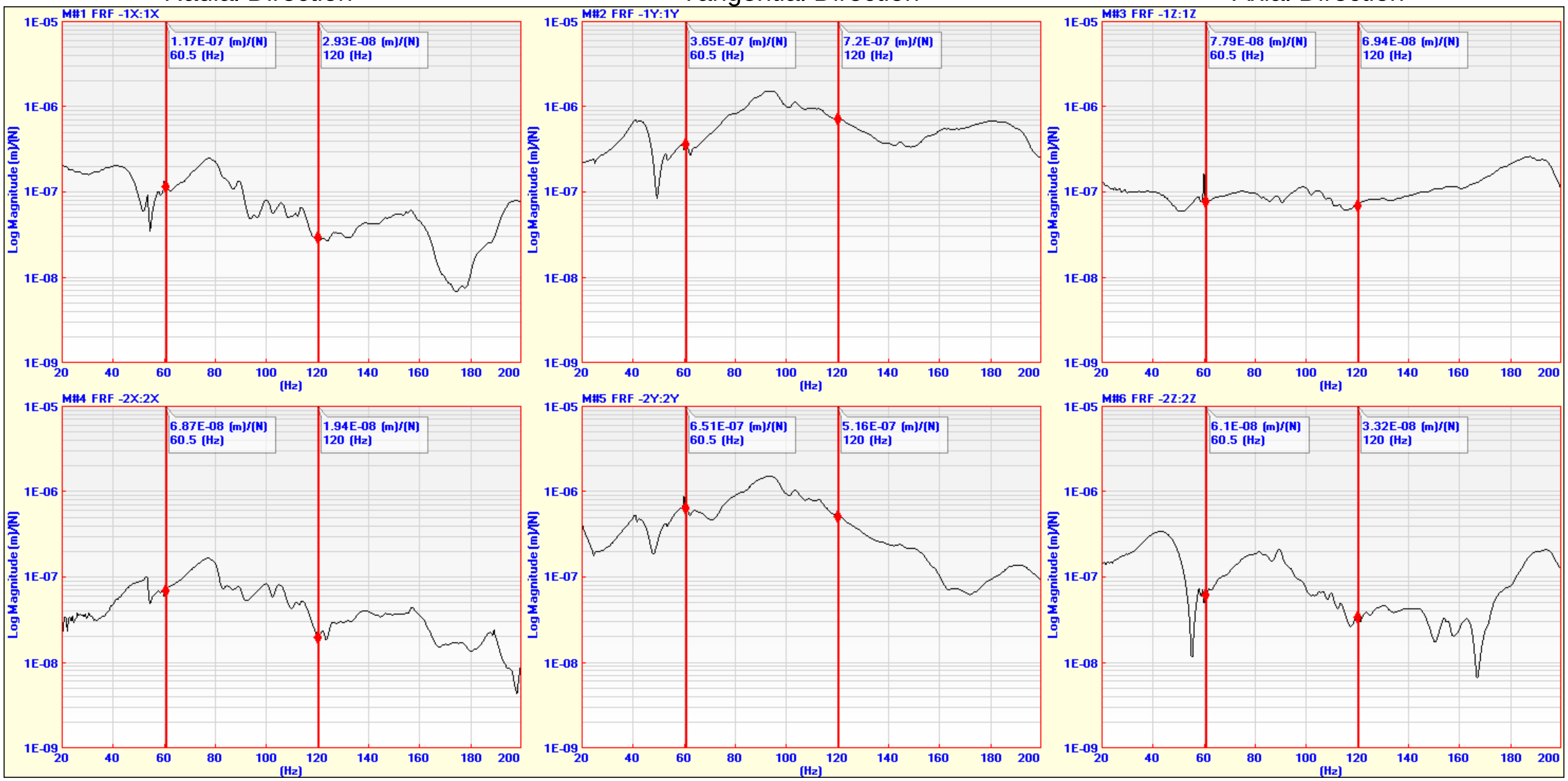


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Figure 12-2 Driving point measurements of PC2
Point A (top row), and point B (bottom row)

Radial Direction | Tangential Direction | Axial Direction

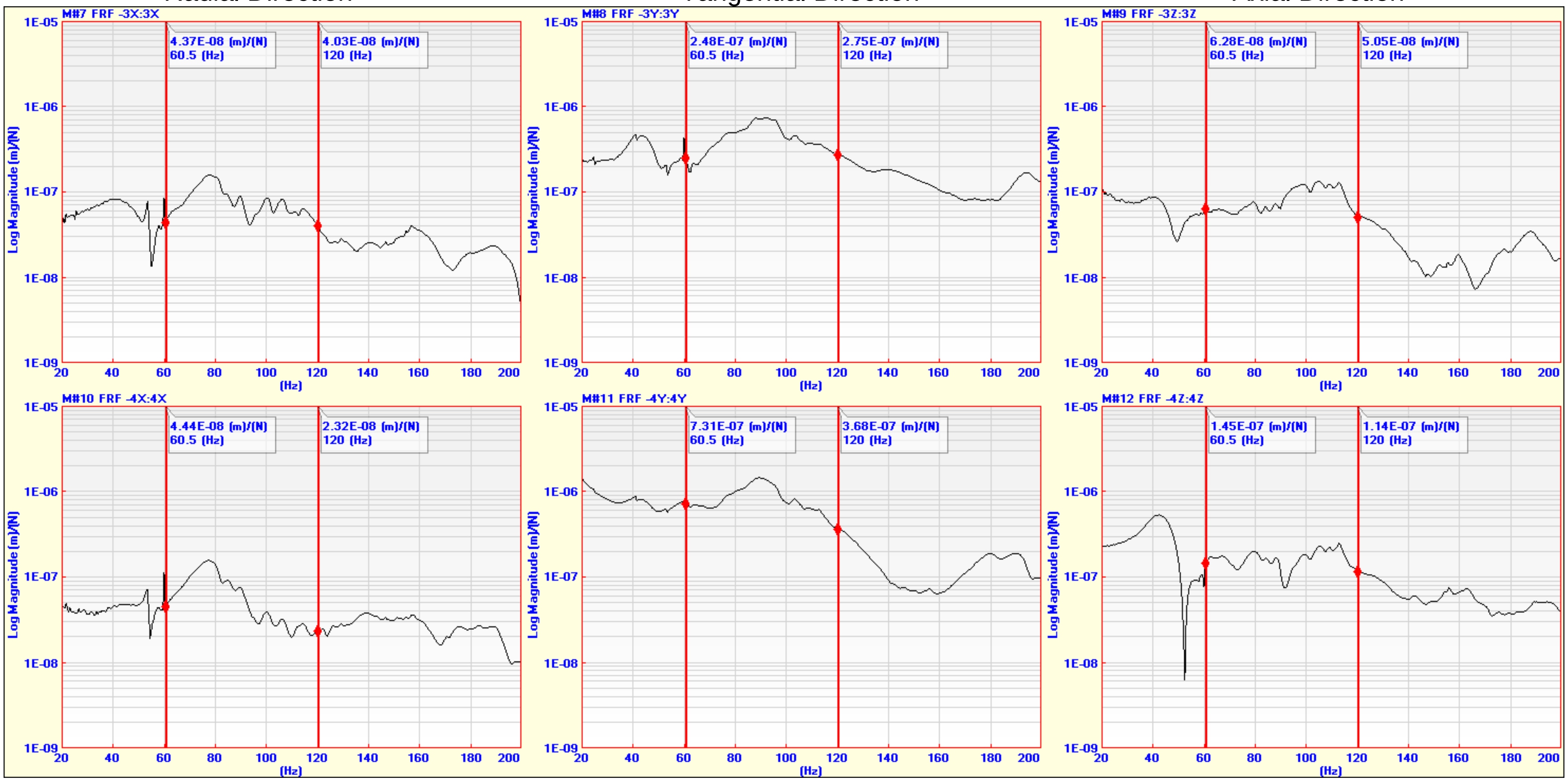

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Figure 12-3 Driving point measurements of PC3
Point A (top row), and point B (bottom row)

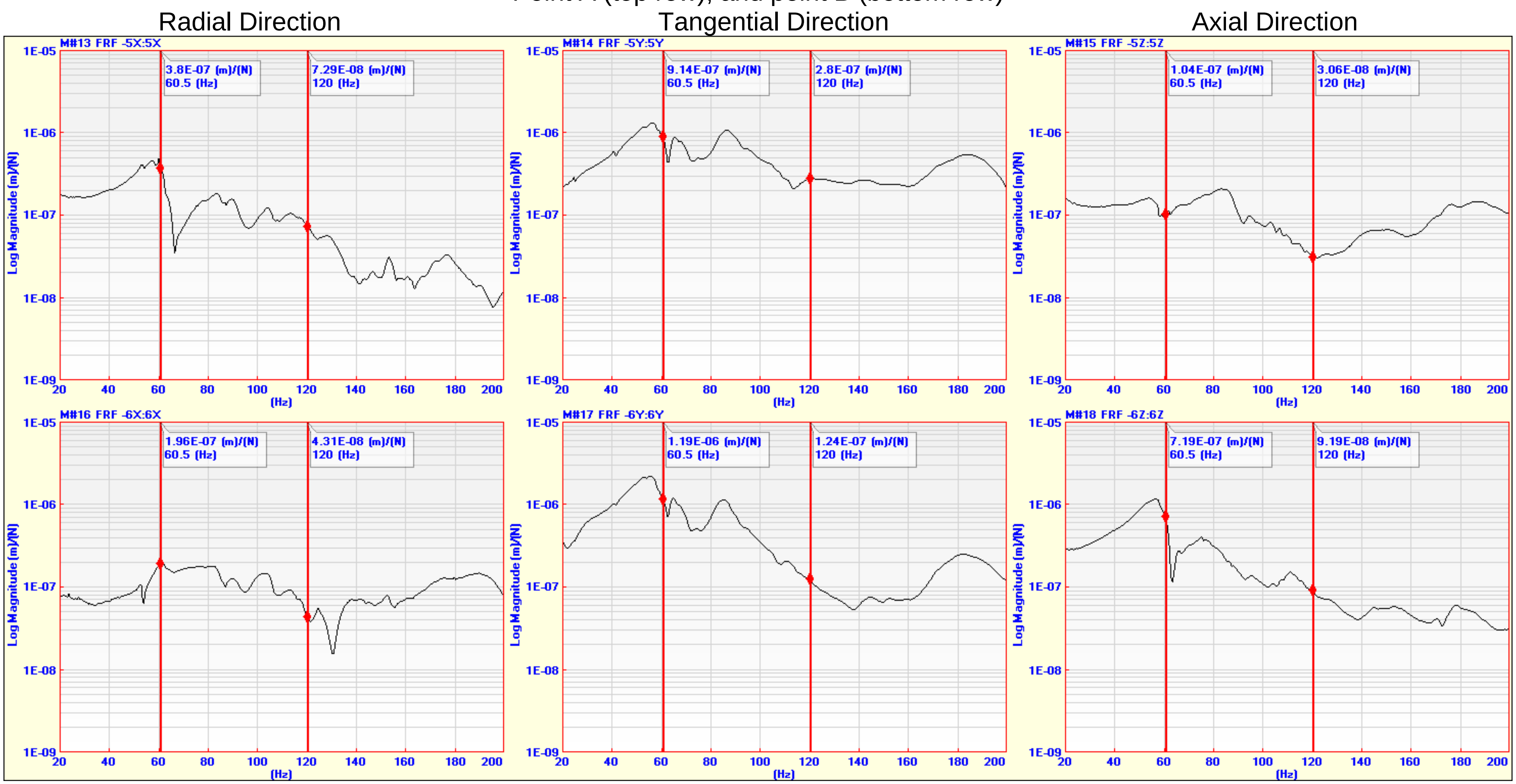

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Figure 12-4 Driving point measurements of PC4
Point A (top row), and point B (bottom row)

Radial Direction | Tangential Direction | Axial Direction

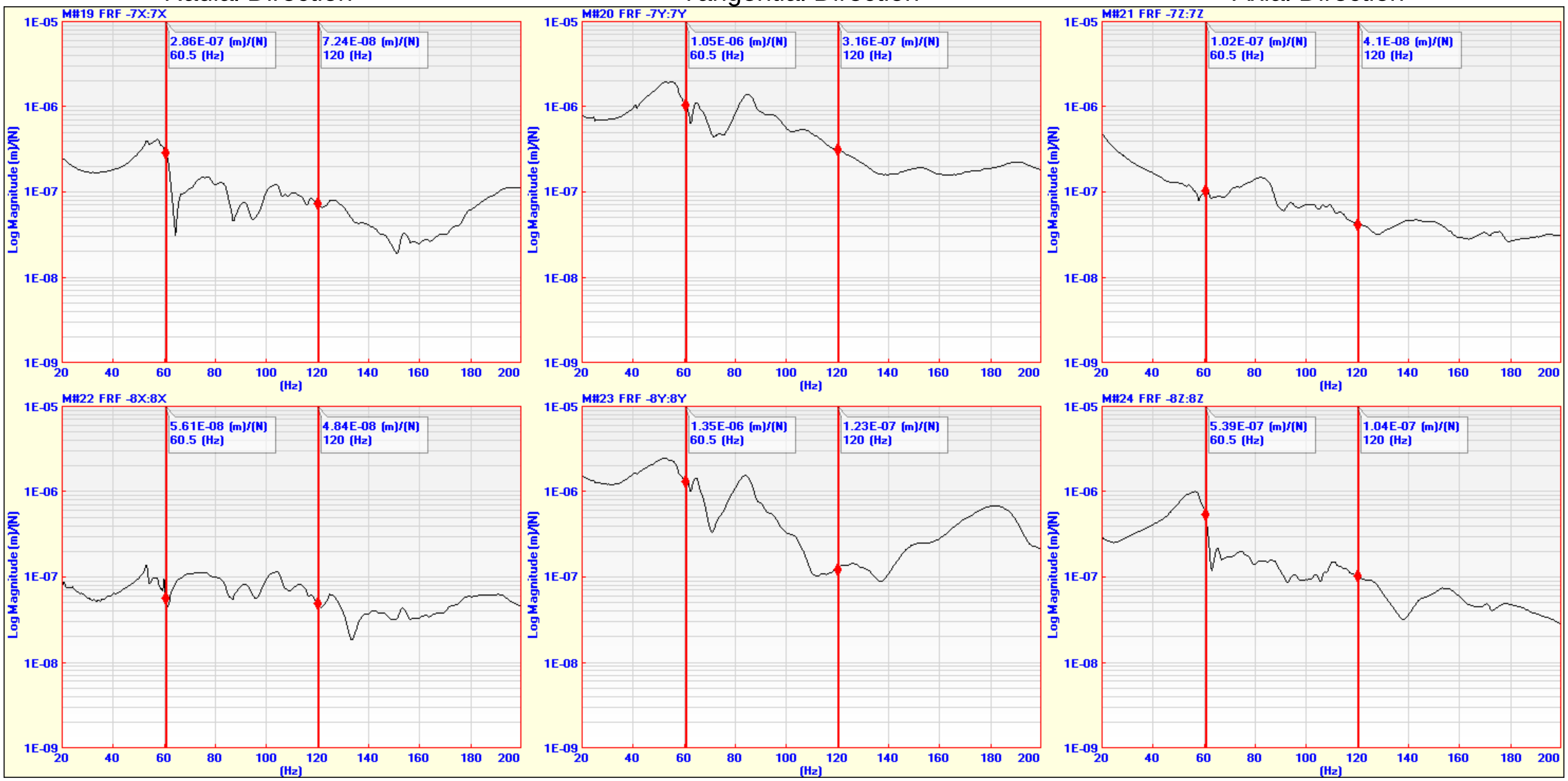

Figure 12-5 Driving point measurements of PC5
Point A (top row), and point B (bottom row)

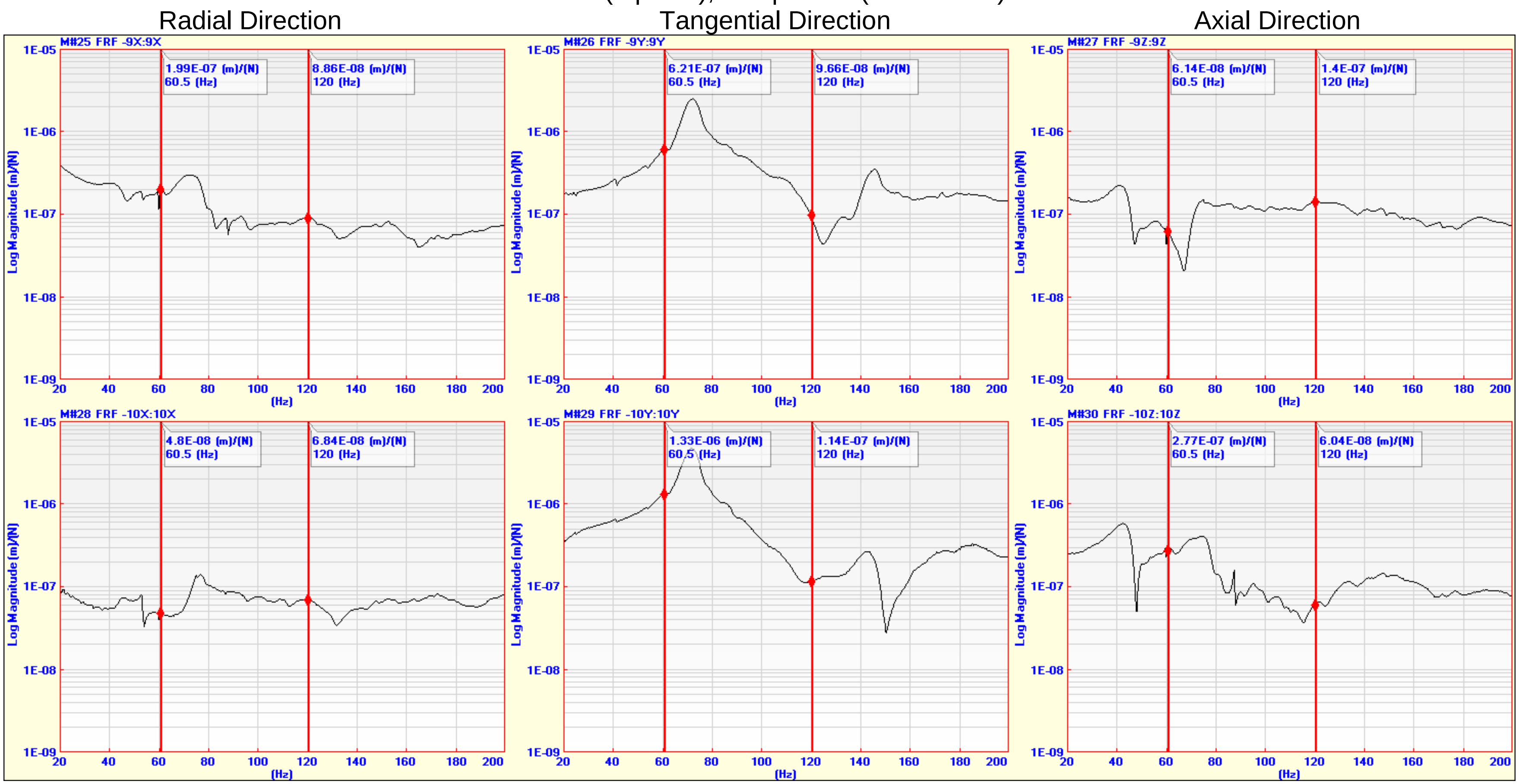

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Figure 12-6 Driving point measurements of PC6
Point A (top row), and point B (bottom row)

Radial Direction | Tangential Direction | Axial Direction

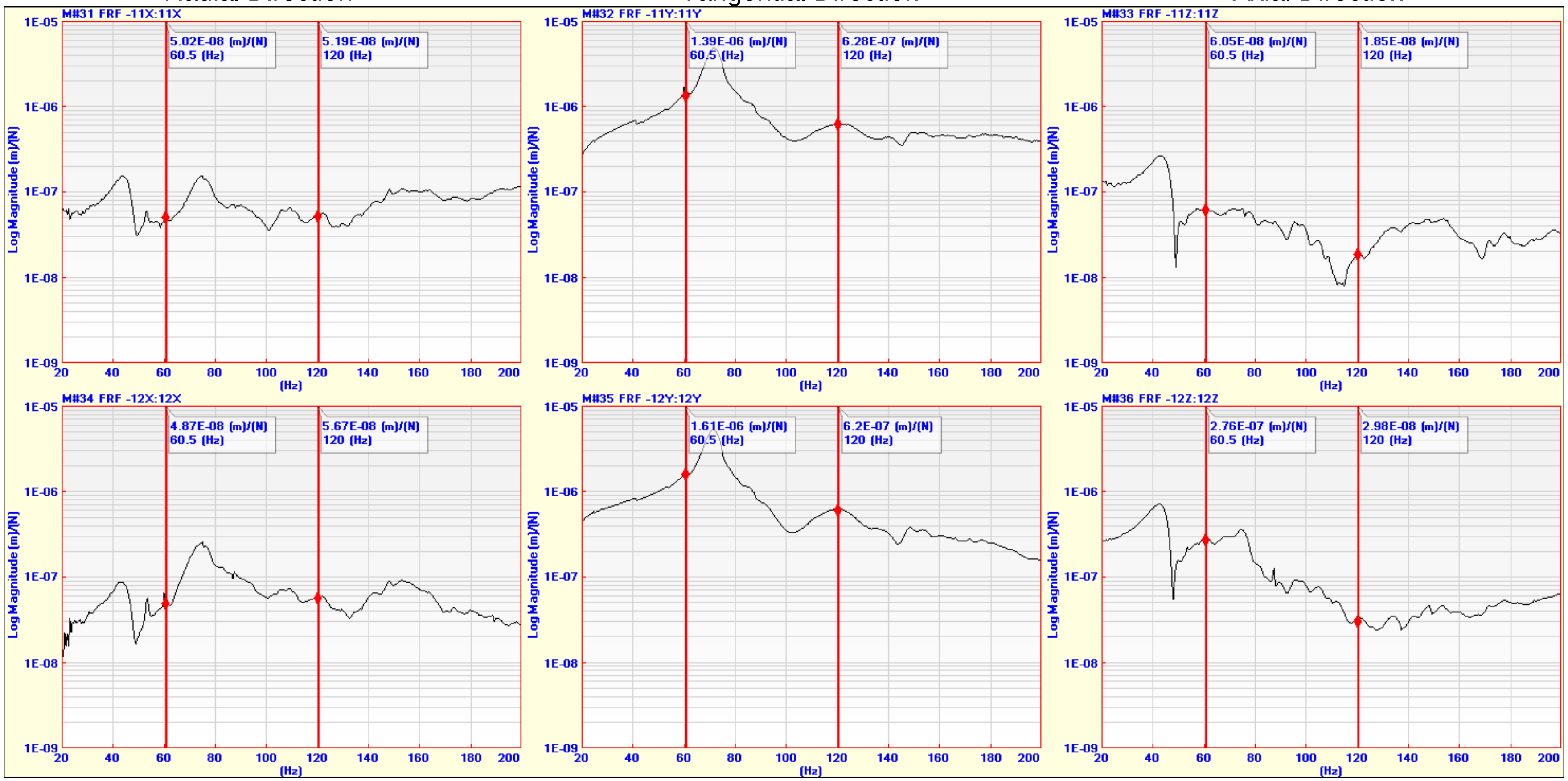

Figure 12-7 Driving point measurements of PC7
Point A (top row), and point B (bottom row)

Radial Direction — Tangential Direction — Axial Direction

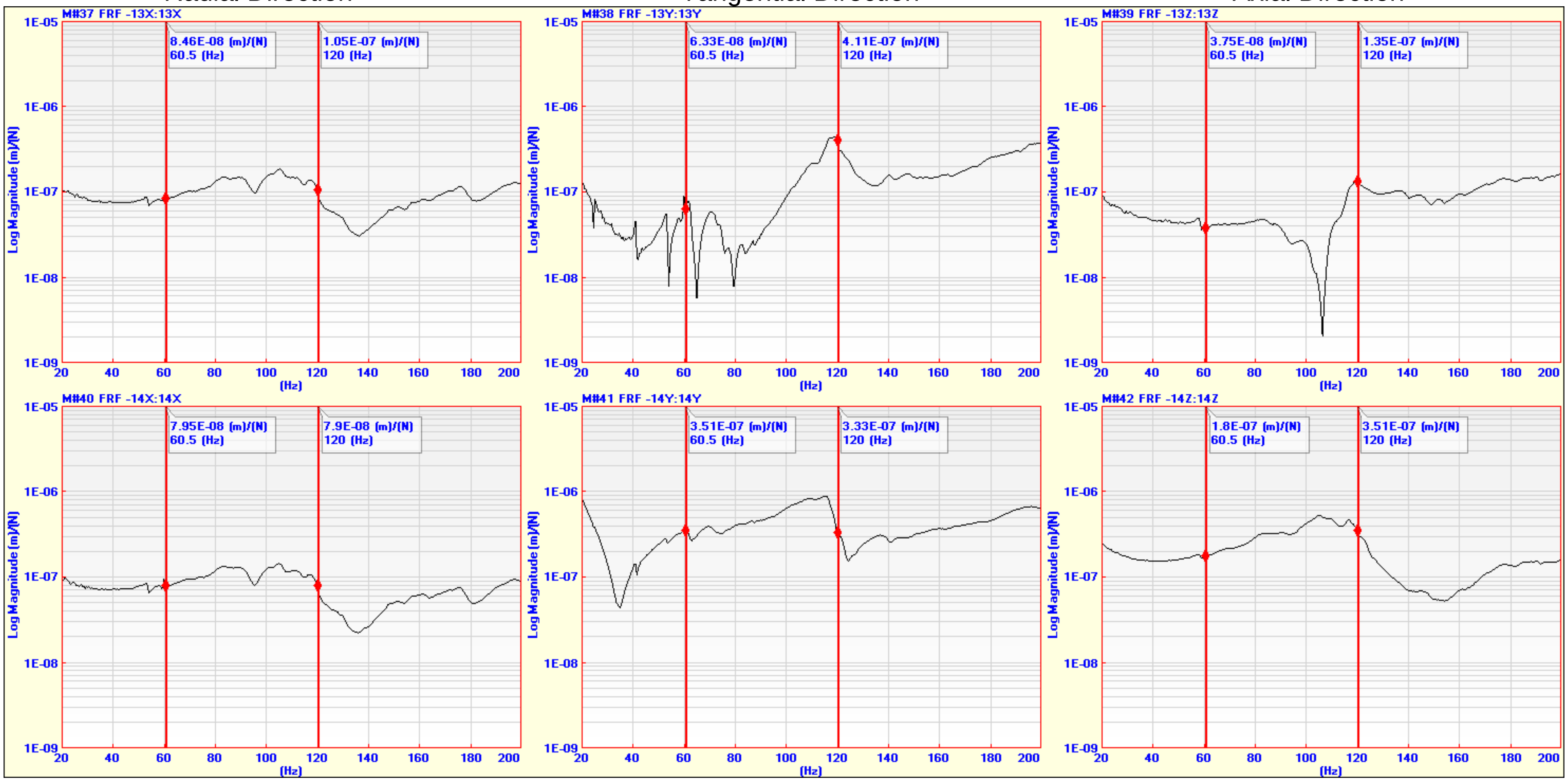

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Figure 12-8 Driving point measurements of PC8
Point A (top row), and point B (bottom row)

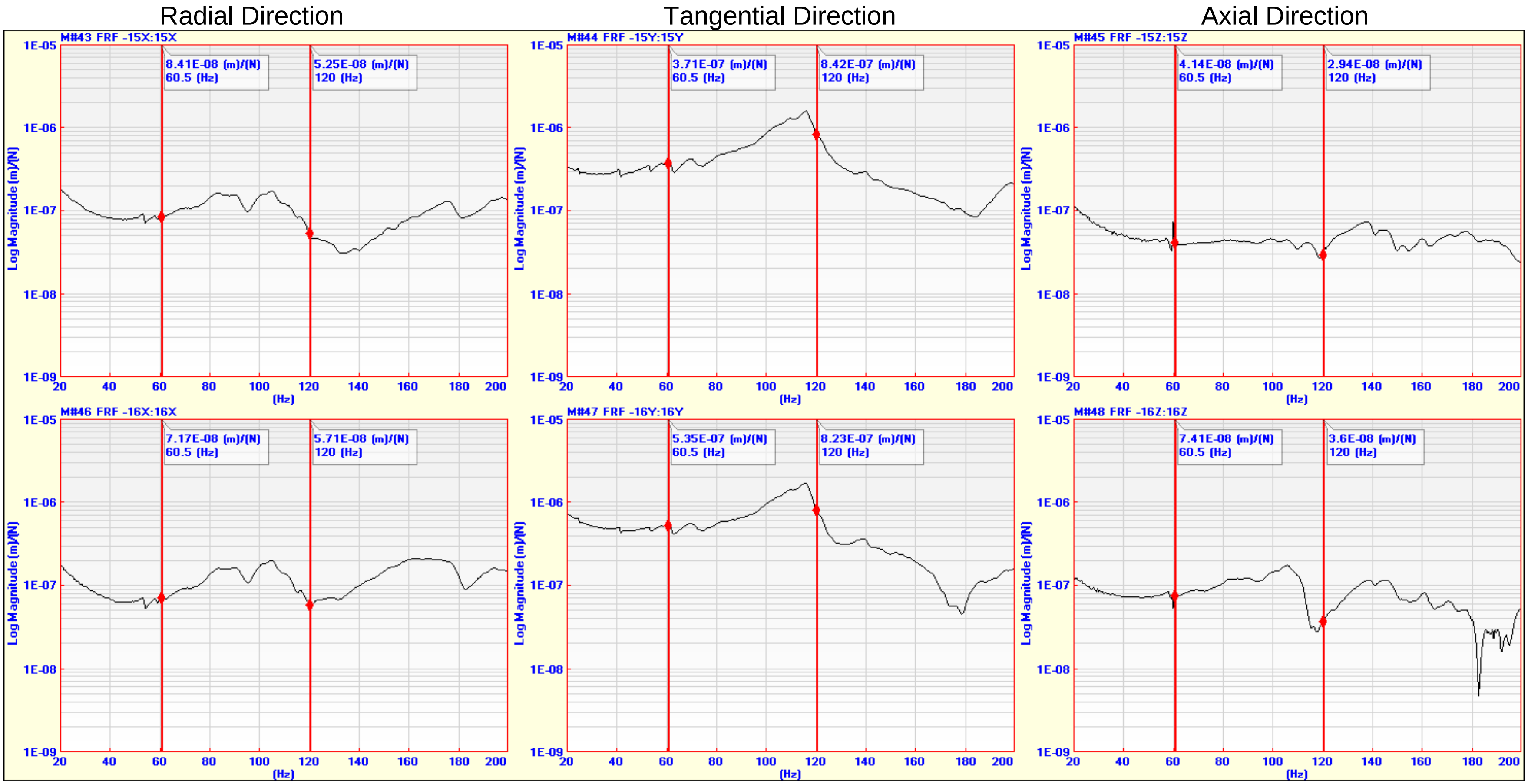

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Figure 12-9 Driving point measurements of PC9
Point A (top row), and point B (bottom row)

Radial Direction Tangential Direction Axial Direction

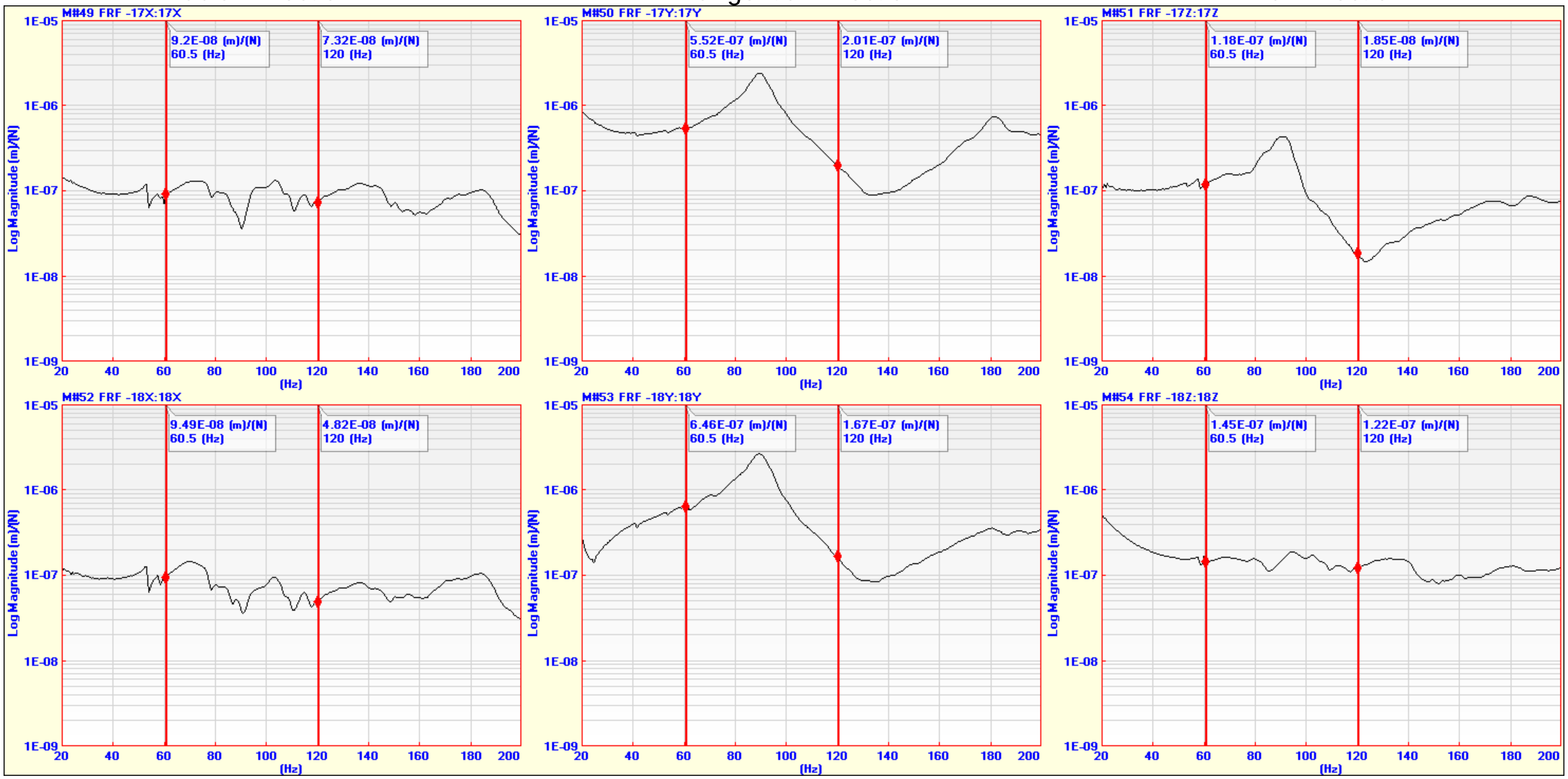

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Figure 12-10 Driving point measurements of PC10
Point A (top row), and point B (bottom row)

Radial Direction Tangential Direction Axial Direction

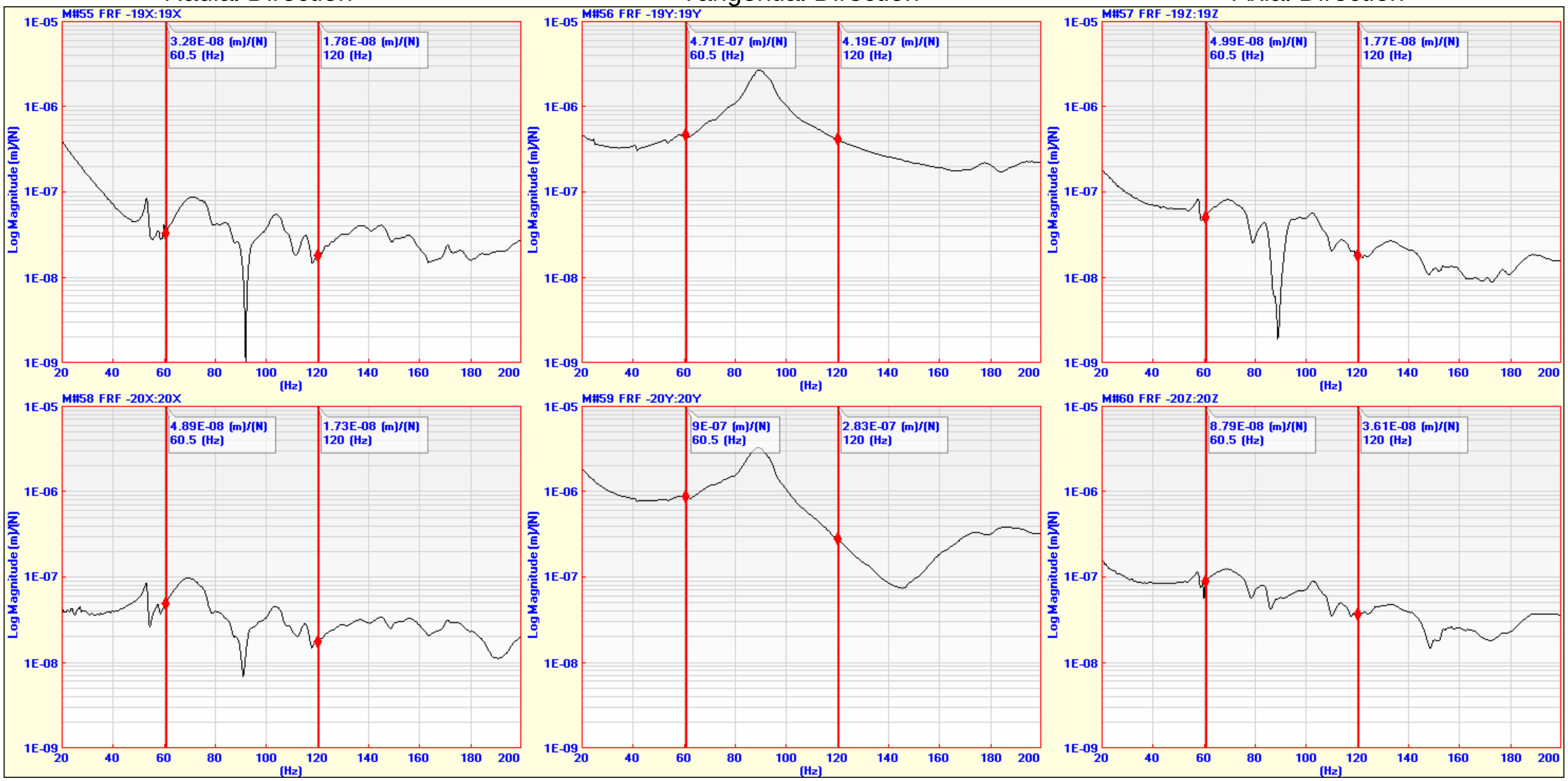

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Figure 12-11 Driving point measurements of PC11
Point A (top row), and point B (bottom row)

Radial Direction Tangential Direction Axial Direction

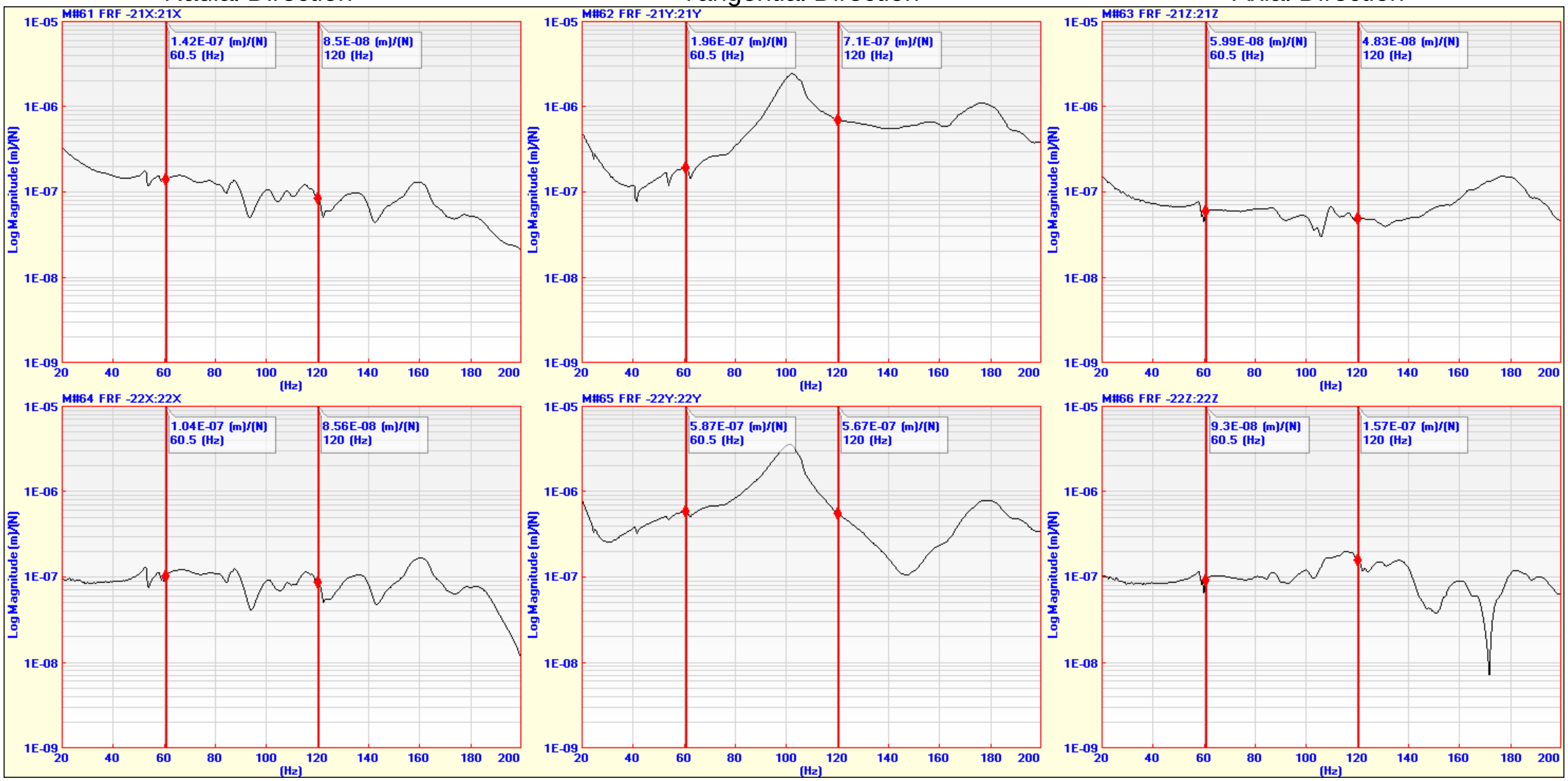

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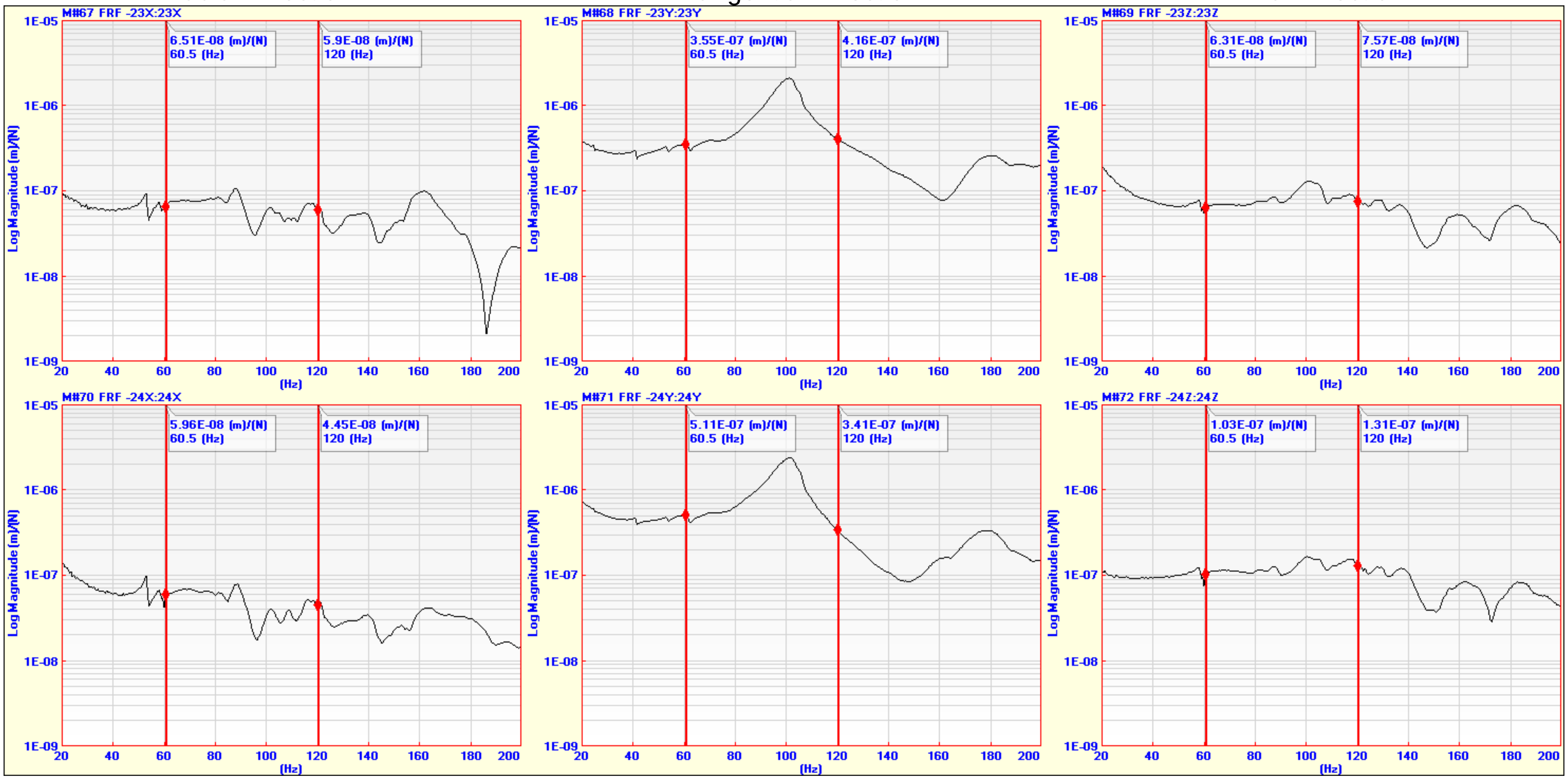
Figure 12-12 Driving point measurements of PC12
Point A (top row), and point B (bottom row)

Radial Direction | Tangential Direction | Axial Direction

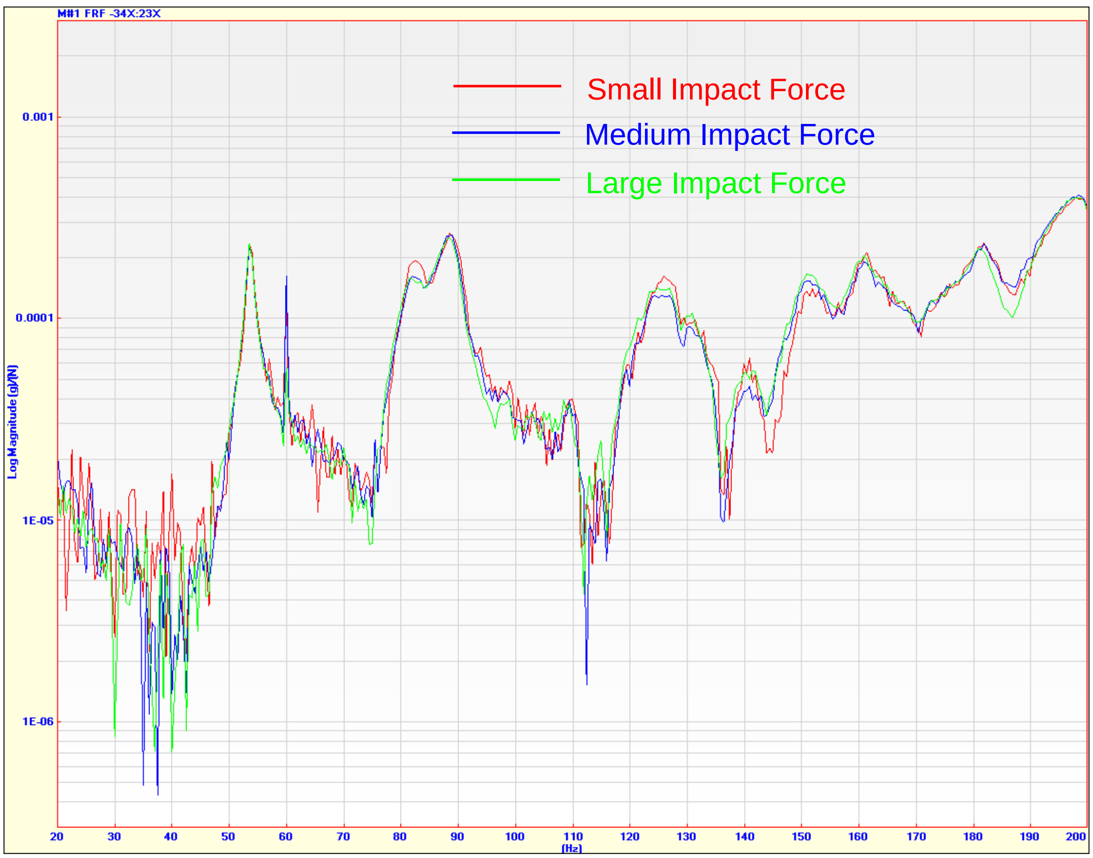


5. DE Measurements

DE Linearity Test

The linearity test was performed by impacting the midsection of the involutes at 6:00 o'clock with three different magnitudes of the impulsive force and measuring the magnitudes of vibration at 12:00 o' clock. The traces of the measured frequency response functions are shown in figure 13. The traces overlap each other closely.

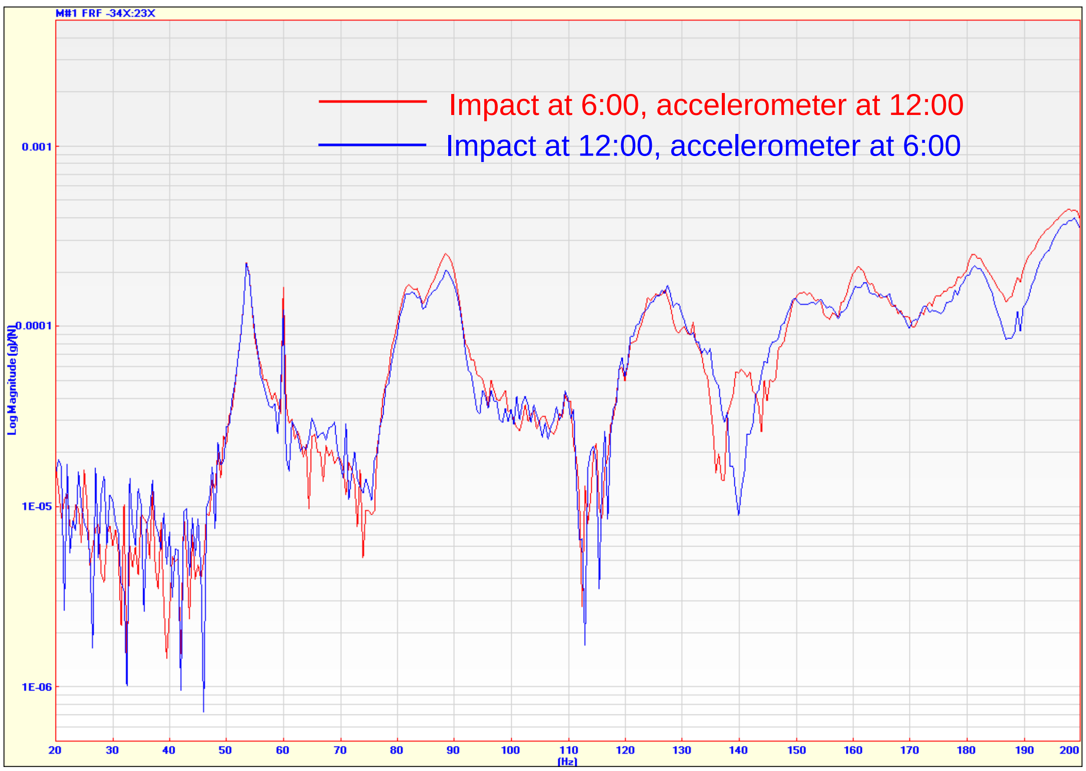
Figure 13. Overlay of traces of frequency response functions from DE linearity test due to three levels of impact force.



DE Reciprocity Test

The reciprocity test was performed by impacting the midsection of the involutes at 6:00 o'clock and measuring the vibrations at 12:00 o'clock, and then impacting at 12:00 o'clock while measuring the vibrations at 6:00 o'clock. The results are plotted in figure 14 and as is shown the traces are overlapping closely.

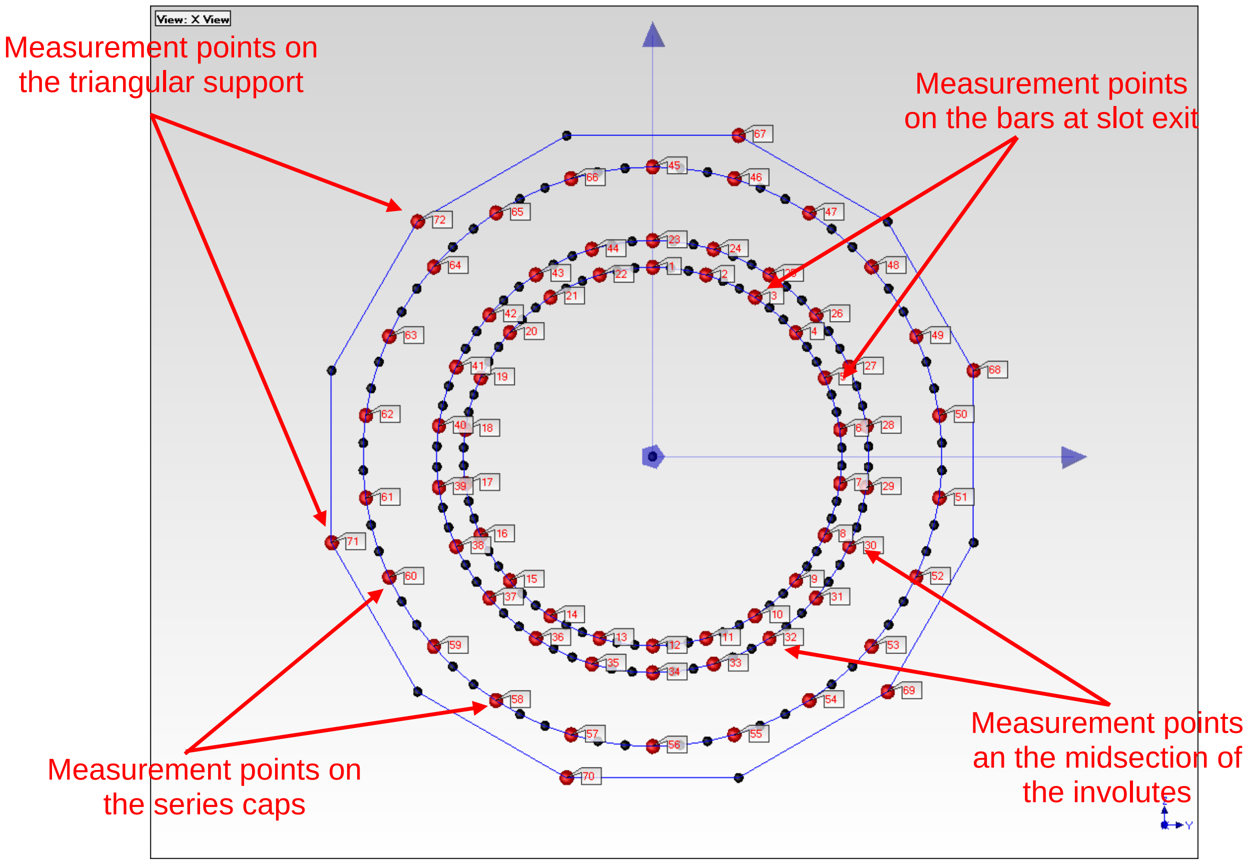
Figure 14. Overlay of traces of frequency response functions from NDE reciprocity test.



DE Global Modal Analysis

The global modal analysis of the DE end winding was performed by impacting at the midsection of the involutes at 06:00 o'clock and measuring the vibrations of the bars at slot exit, at the midsection of the involutes, on the series cap, and at triangular support. As shown in Figure 15 the vibrations at the slot exit, at the midsection of the involutes, and on the series caps are measured on every third bar for a total of 66 measurement points. The vibrations of the bracket were measured on six out of twelve brackets.

Figure 15 Measurement locations of the DE global modal analysis



The following table summarizes the natural frequencies and the corresponding mode shapes found by the bump test from 40 Hz to 160 Hz:

Table 2.DE End Winding
Natural Frequencies and Corresponding Mode Shapes

	Frequency (Hz)	Mode Shape	Note
1	53.5	2-node Circular	See Figure 16-1
2	60	Irrigular	
3	75.5	Irrigular	
4	81	4-node Elliptical	See Figure 16-2
5	84	4-node Elliptical	See Figure 16-3
6	89.5	4-node Elliptical	See Figure 16-4
7	99.5	6-node 3-Lobe	See Figure 16-5
8	105	8-node 4 Lobe	See Figure 16-6
9	Higher Frequency	8-node 4 Lobe	
10			
11			
12			

Figure 16-1 shows a bending mode shape at the frequency of 53.5 Hz. Figures 16-2 through 16-4 show a well-established elliptical mode shape at the frequencies of 81 Hz, 84 Hz, and 89.5 Hz, respectively. The frequencies of these mode shapes are well below the critical range of 115 Hz to 135 Hz.

The mode shapes shown in Figure 16-5 is a 6-node, 3-Lobe mode shape, which the end winding retains a triangular shape. The natural frequency for this mode shape occur at 99.5 Hz. Figure 16-6 shows an 8-node, 4-Lobe mode shape at the frequency of 105 Hz. Natural frequencies greater than 105 Hz all have a 8-node, 4-Lobe mode shape. The rotating field cannot excite these mode shapes.

Figure 16-1 DE Mode Shape at 53.5 Hz

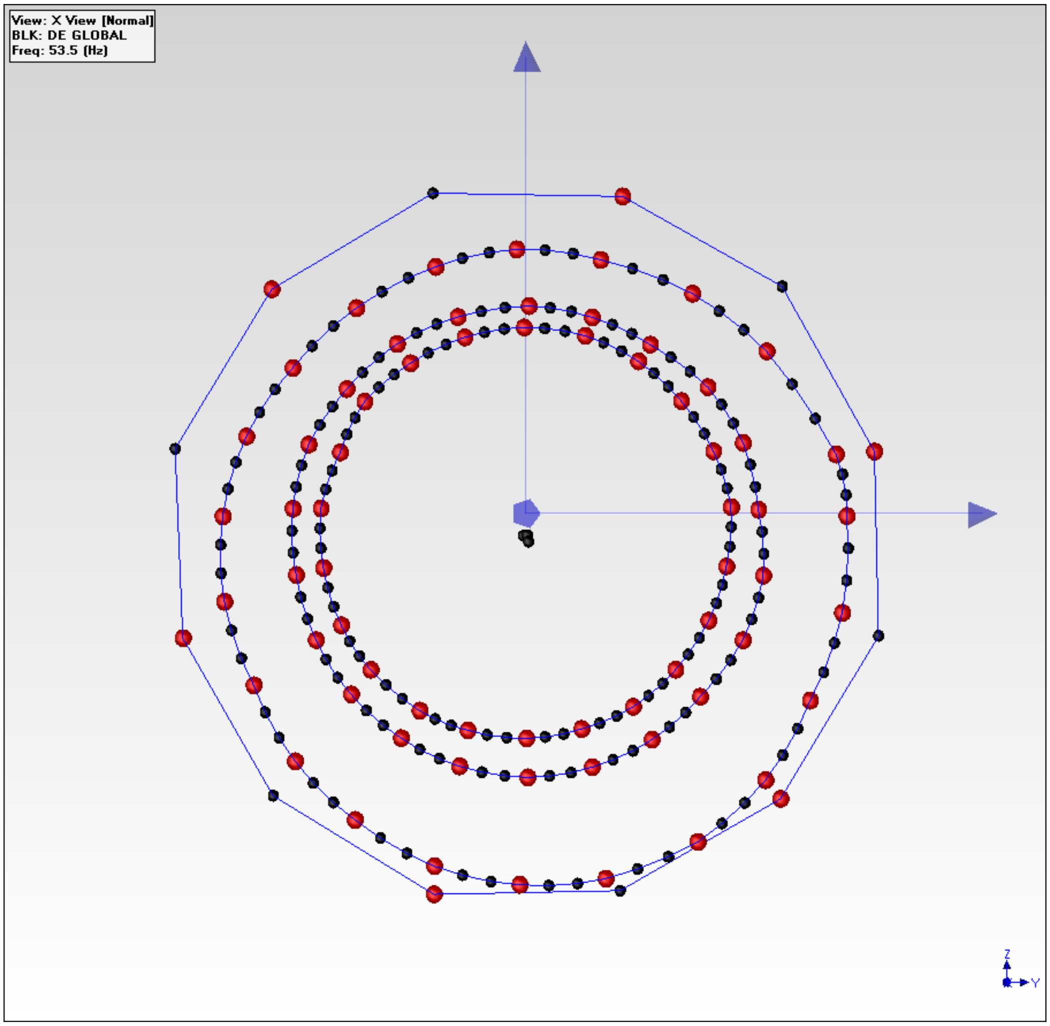


Figure 16-2 DE Mode Shape at 81 Hz

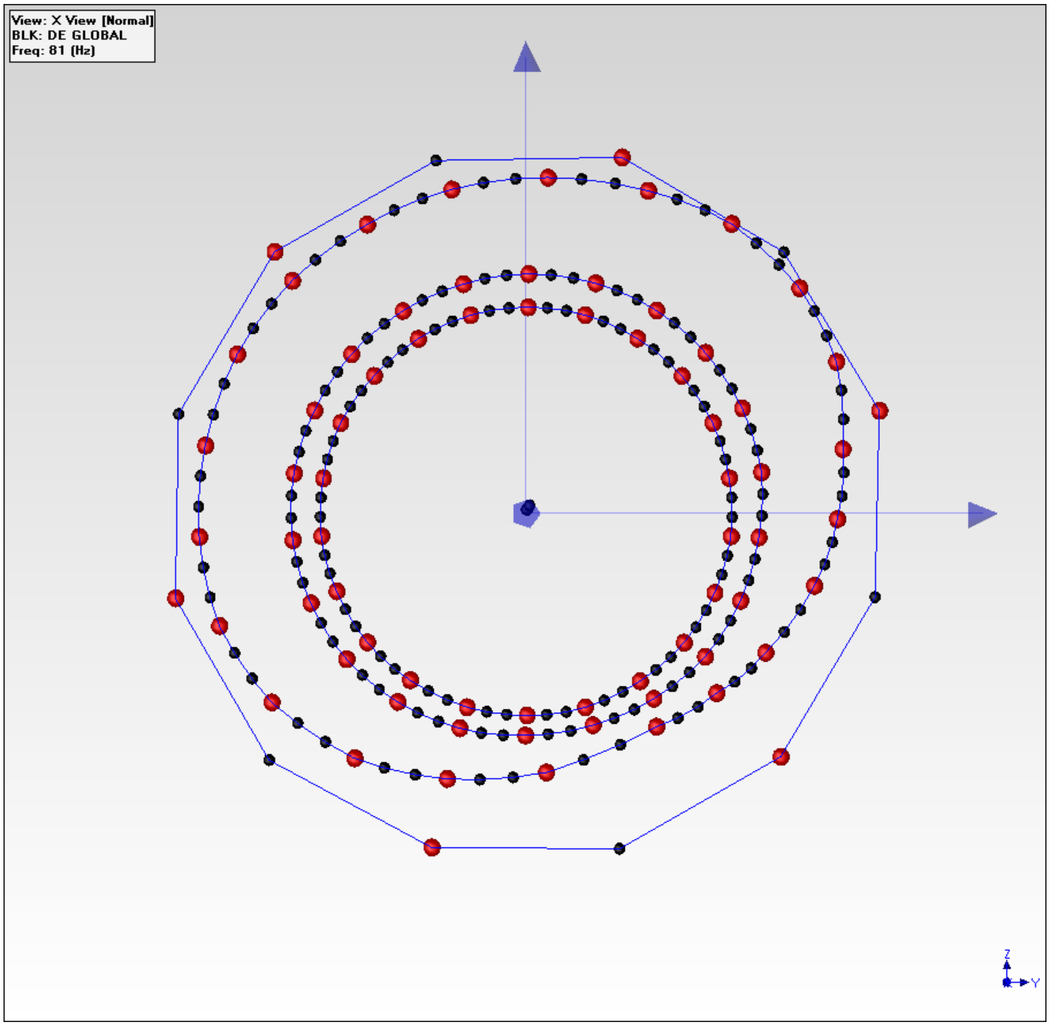


Figure 16-3 DE Mode Shape at 84 Hz

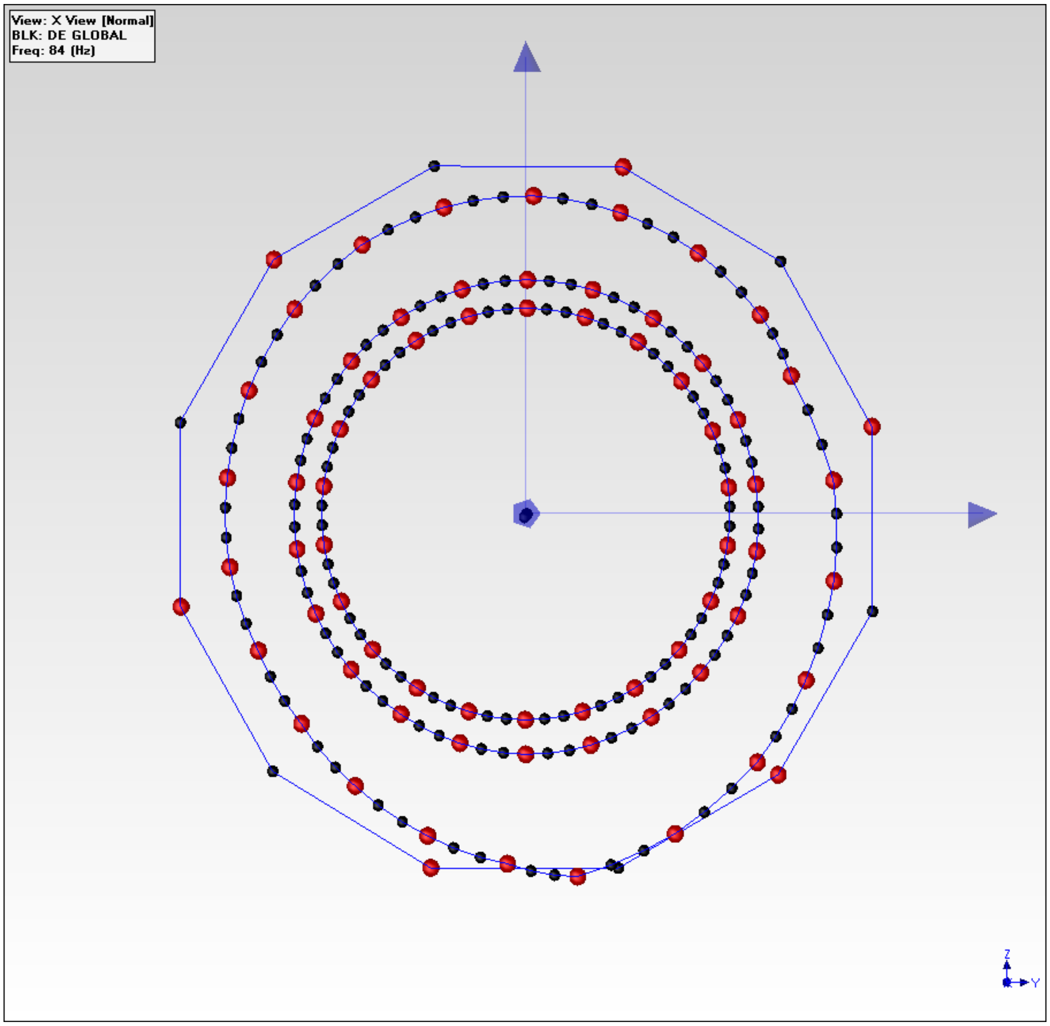


Figure 16-4 DE Mode Shape at 89.5 Hz

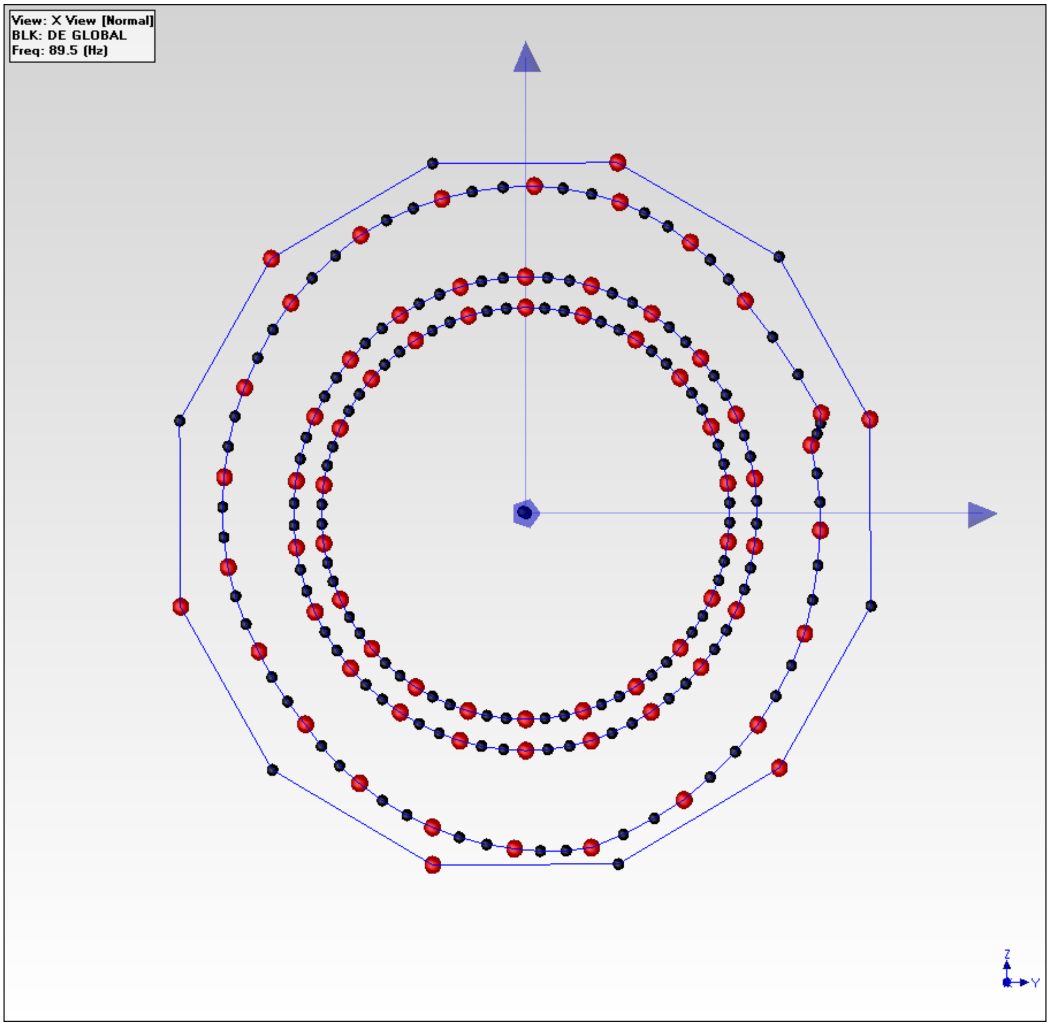


Figure 16-5 DE Mode Shape at 99.5 Hz

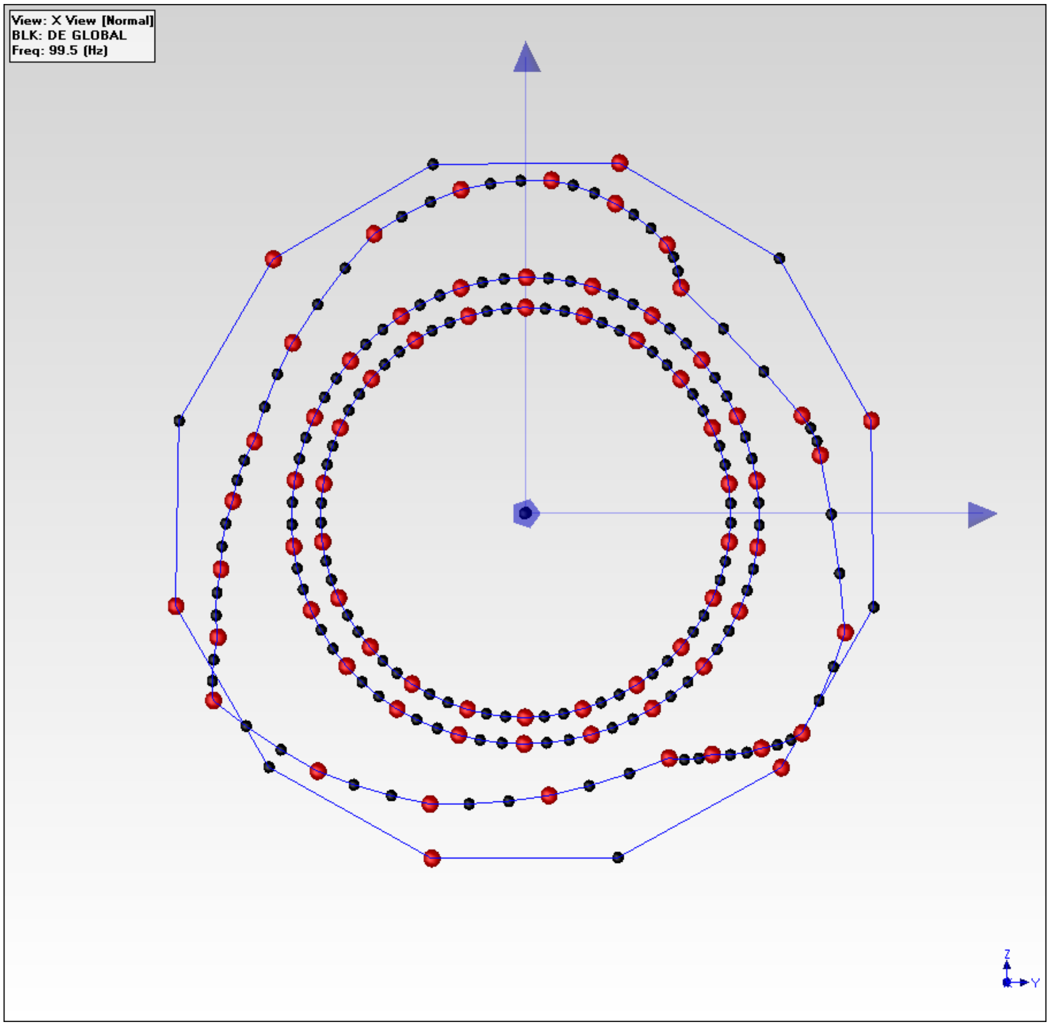
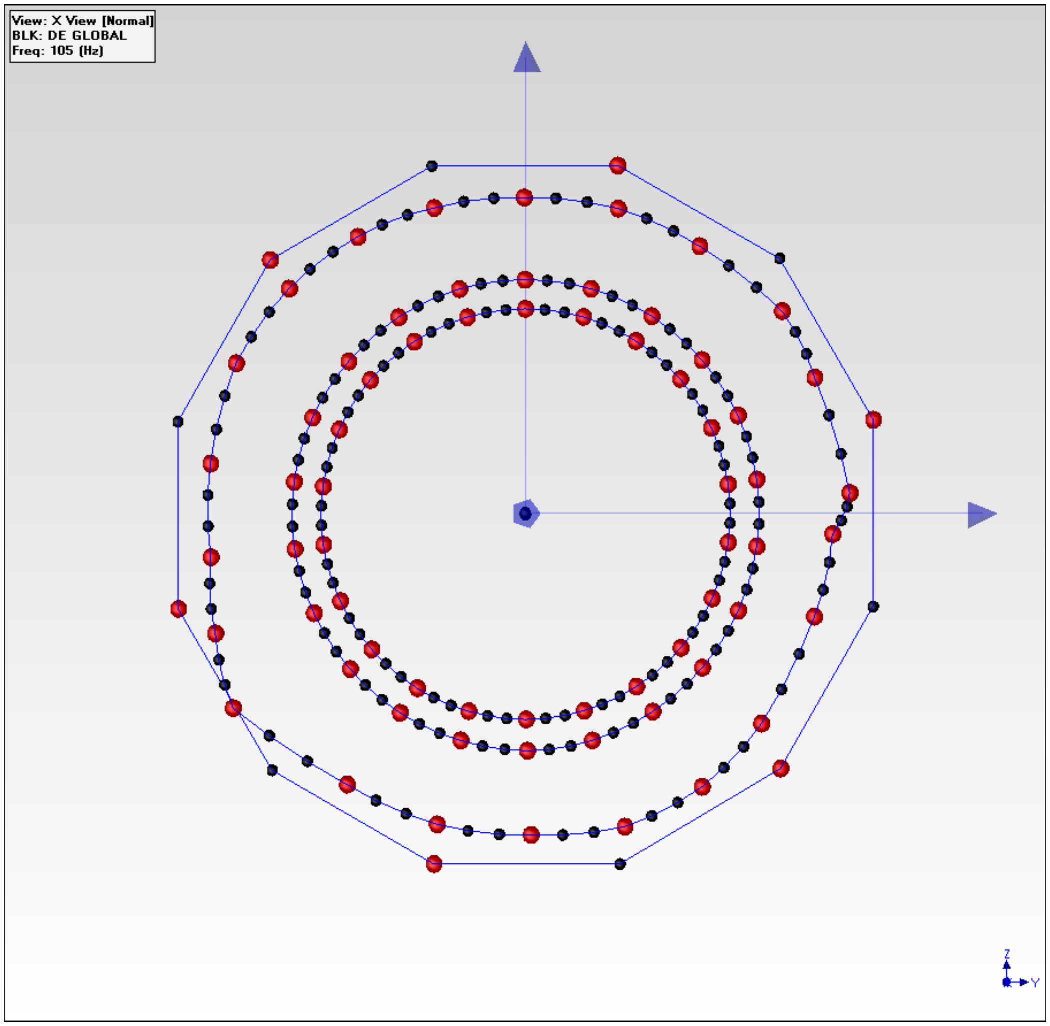


Figure 16-6 DE Mode Shape at 105 Hz



DE Driving Point Measurements of the Caps

The driving point measurements of the caps were performed by impacting each cap in radial direction and measuring the vibrations on the face of the corresponding cap in radial, tangential, and axial directions. The circumferential locations of the series caps are shown in figure 17. The results are plotted in figures 18-1 through 18-22. As shown in these figures, the magnitudes of vibrations in the tangential direction are relatively high at 120 Hz and exceed the ALSTOM acceptance criterion of 500 nm/N.

Figure 17 Locations of the DE caps around the circumference

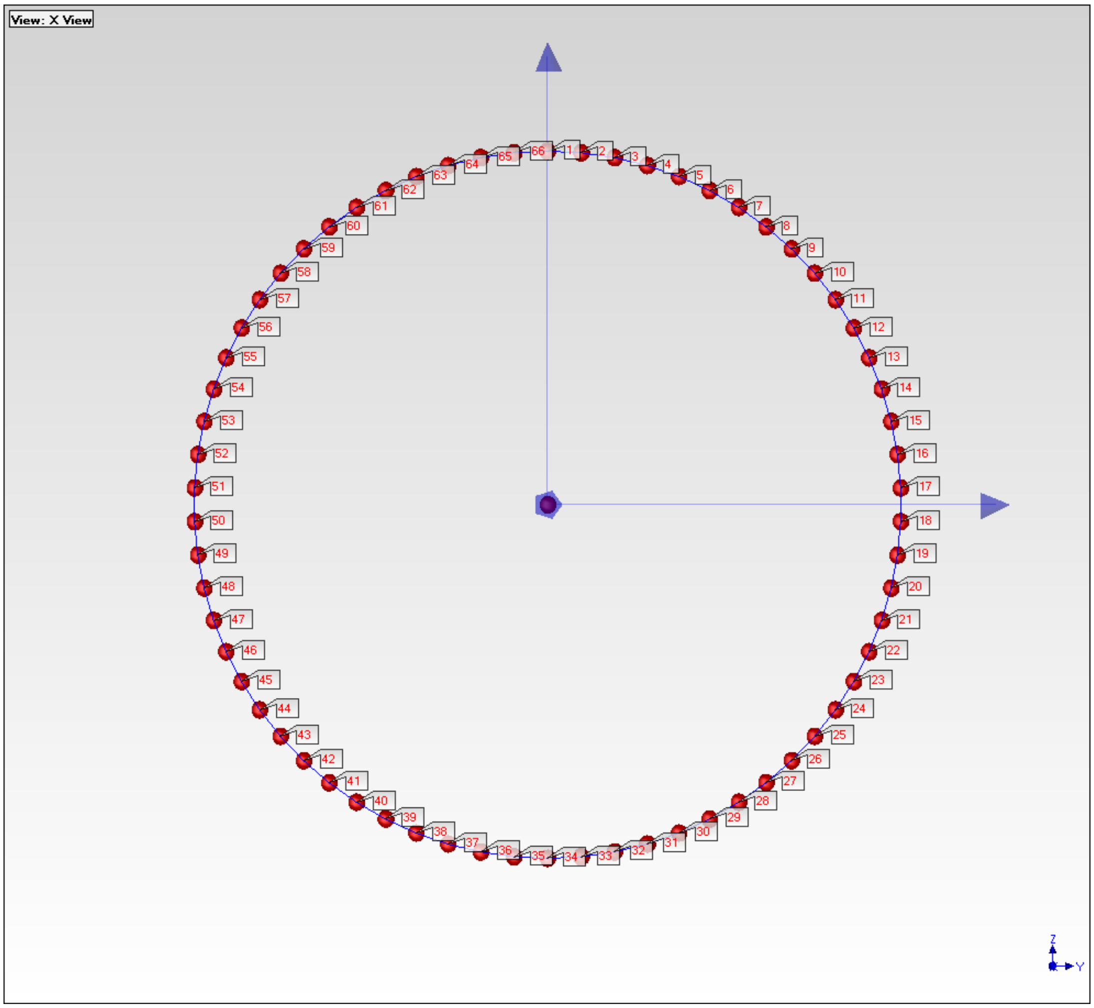


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Figure 18-1 Driving point measurements of DE SERIES CAPS
Cap numbered 1 (top row), Cap numbered 2 (middle row), and Cap numbered 3 (bottom row)

Radial Direction Tangential Direction Axial Direction

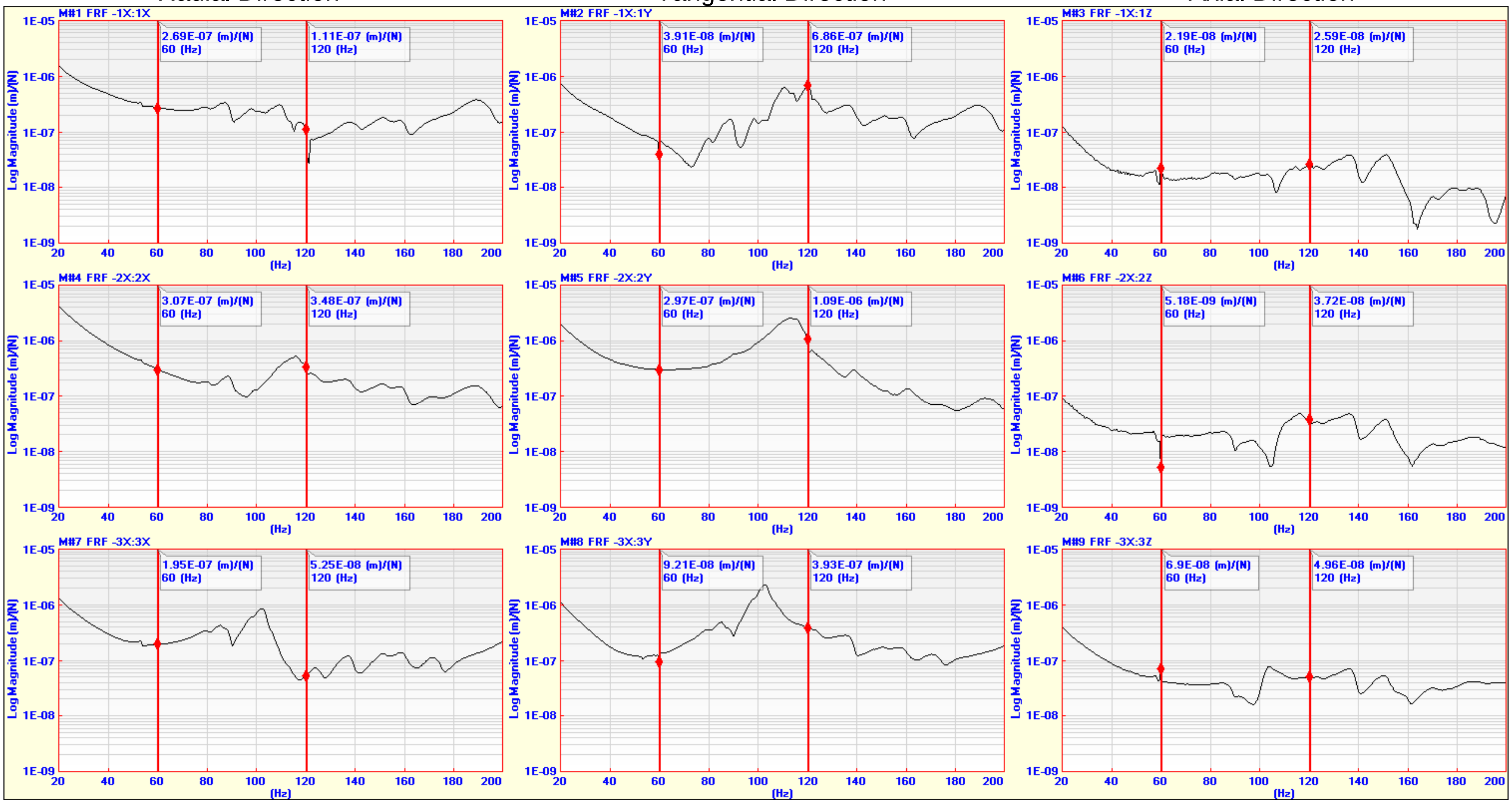

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Figure 18-2 Driving point measurements of DE SERIES CAPS
Cap numbered 4 (top row), Cap numbered 5 (middle row), and Cap numbered 6 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

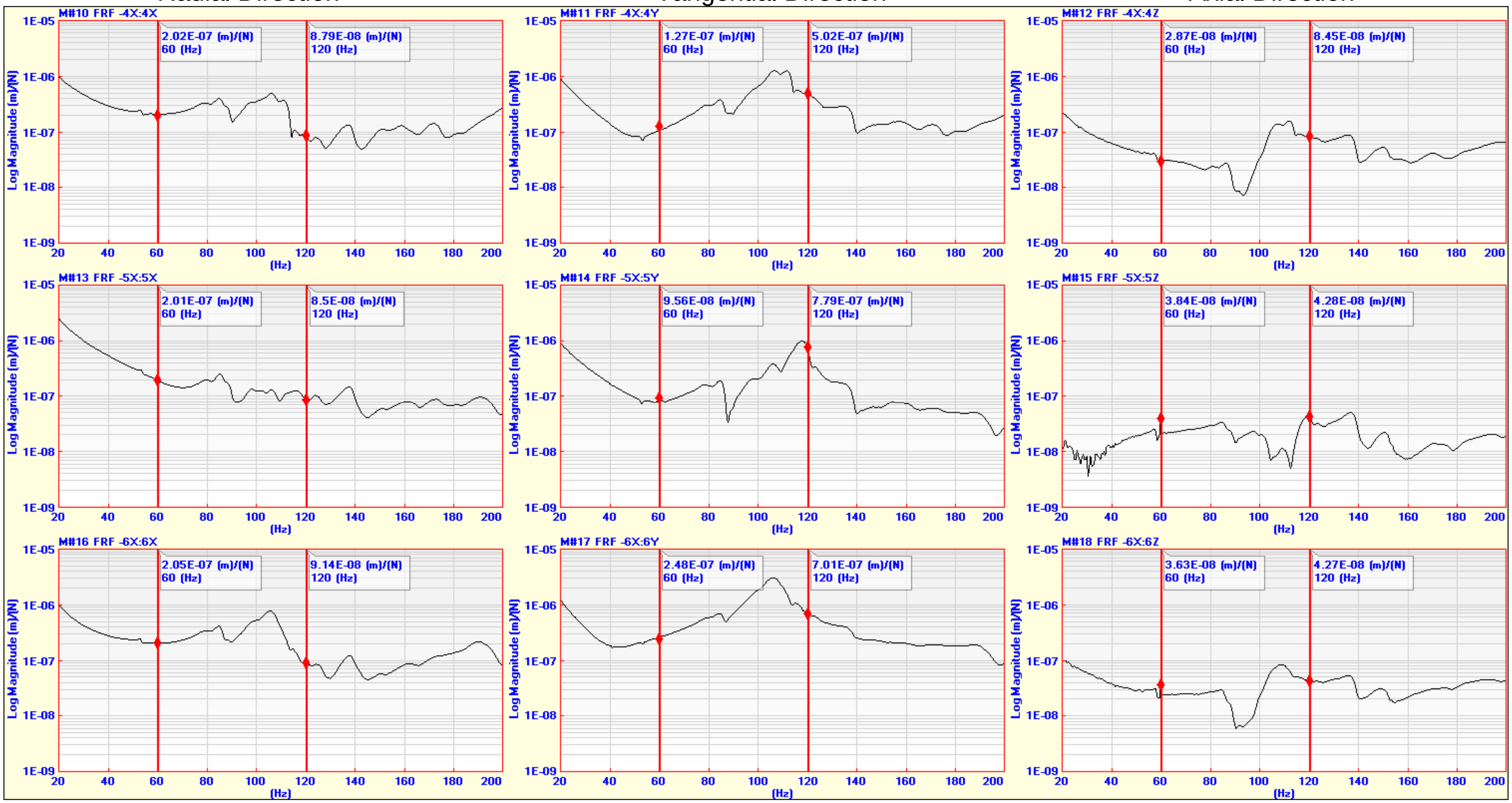

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Figure 18-3 Driving point measurements of DE SERIES CAPS
Cap numbered 7 (top row), Cap numbered 8 (middle row), and Cap numbered 9 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

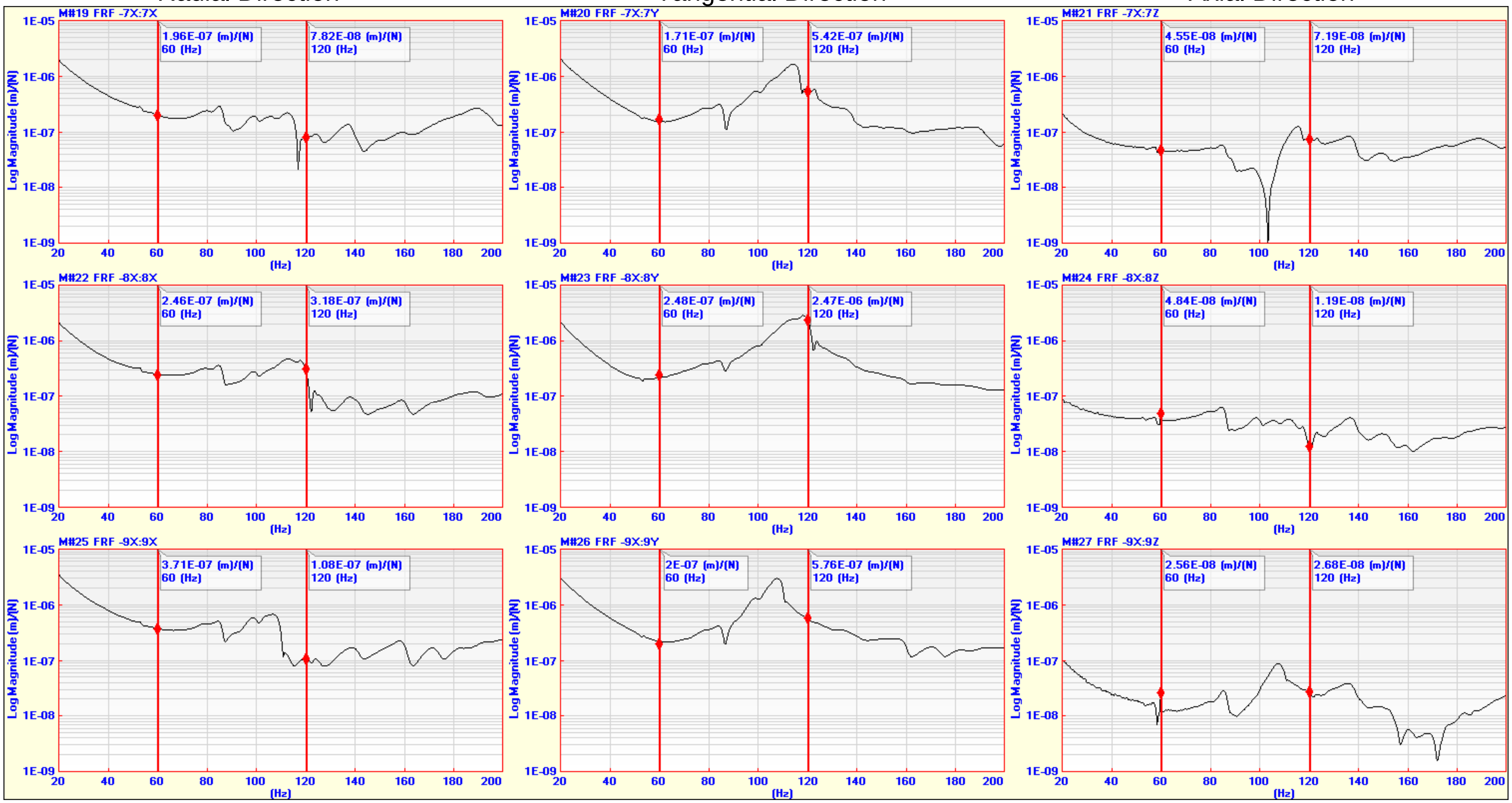

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Figure 18-4 Driving point measurements of DE SERIES CAPS
Cap numbered 10 (top row), Cap numbered 11 (middle row), and Cap numbered 12 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

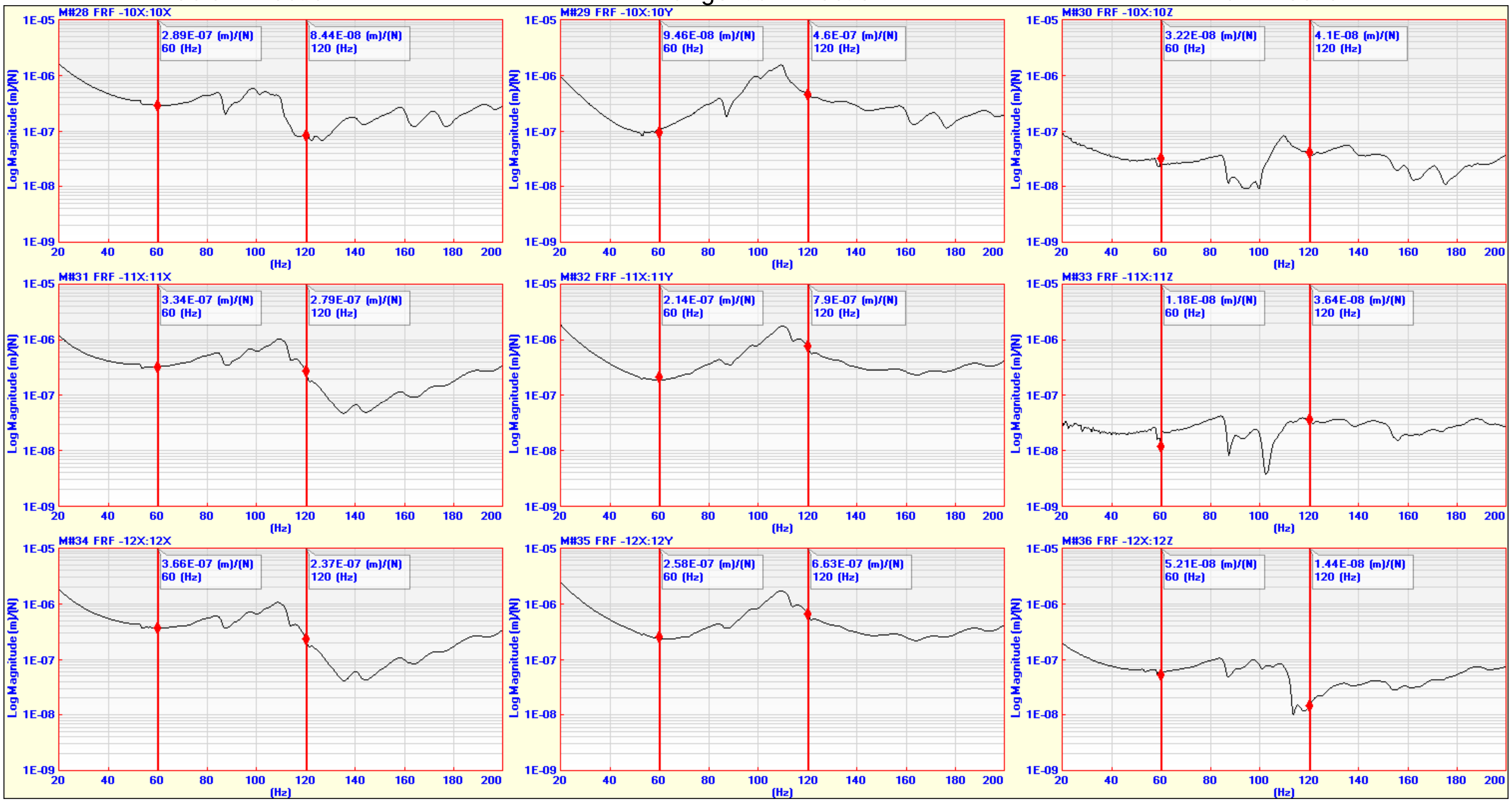

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Figure 18-5 Driving point measurements of DE SERIES CAPS
Cap numbered 13 (top row), Cap numbered 14 (middle row), and Cap numbered 15 (bottom row)

Radial Direction · Tangential Direction · Axial Direction

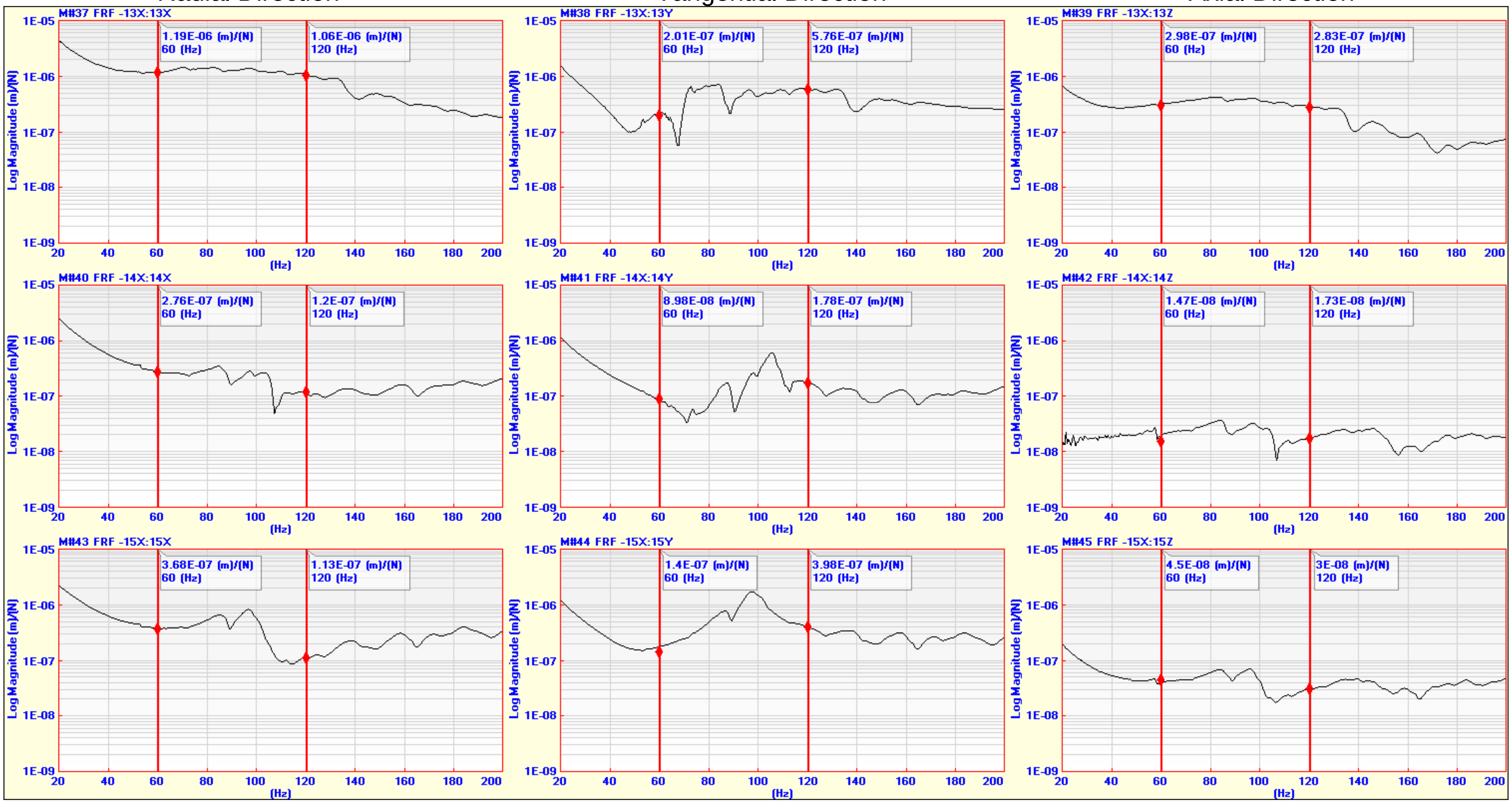

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Figure 18-6 Driving point measurements of DE SERIES CAPS
Cap numbered 16 (top row), Cap numbered 17 (middle row), and Cap numbered 18 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

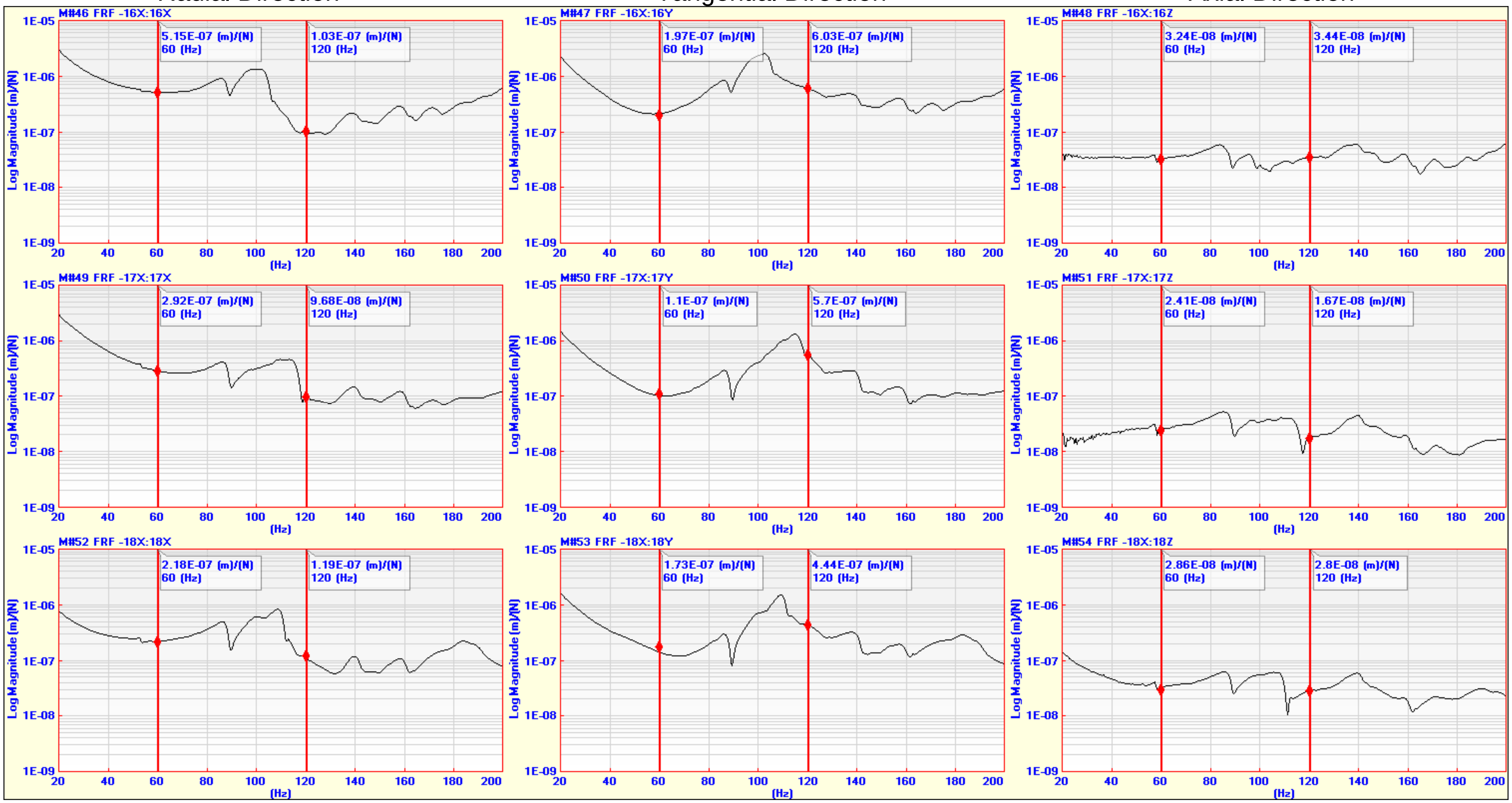
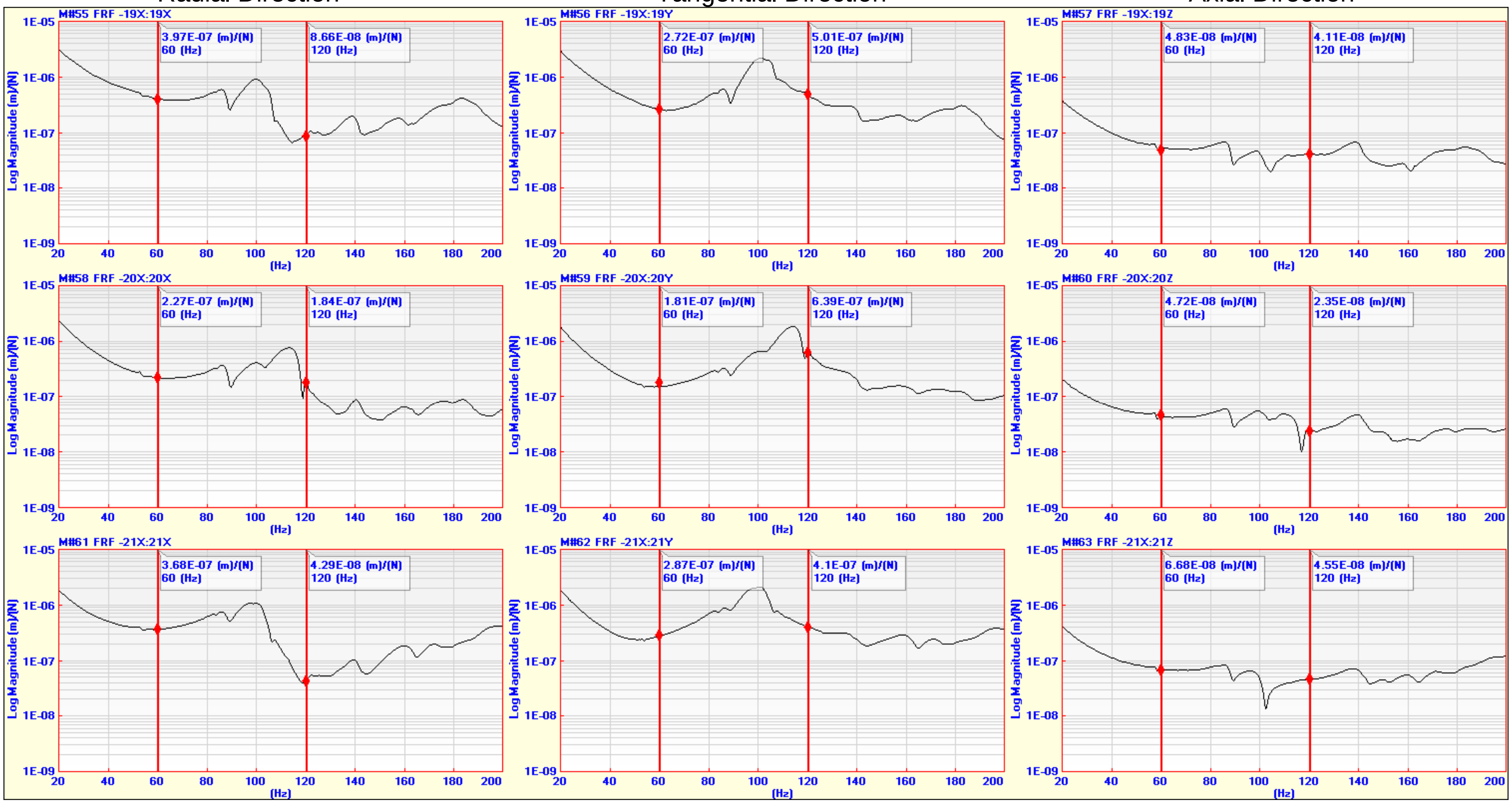


Figure 18-7 Driving point measurements of DE SERIES CAPS
Cap numbered 19 (top row), Cap numbered 20 (middle row), and Cap numbered 21 (bottom row)

Radial Direction | Tangential Direction | Axial Direction



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FSRG015977

Figure 18-8 Driving point measurements of DE SERIES CAPS
Cap numbered 22 (top row), Cap numbered 23 (middle row), and Cap numbered 24 (bottom row)

Radial Direction Tangential Direction Axial Direction

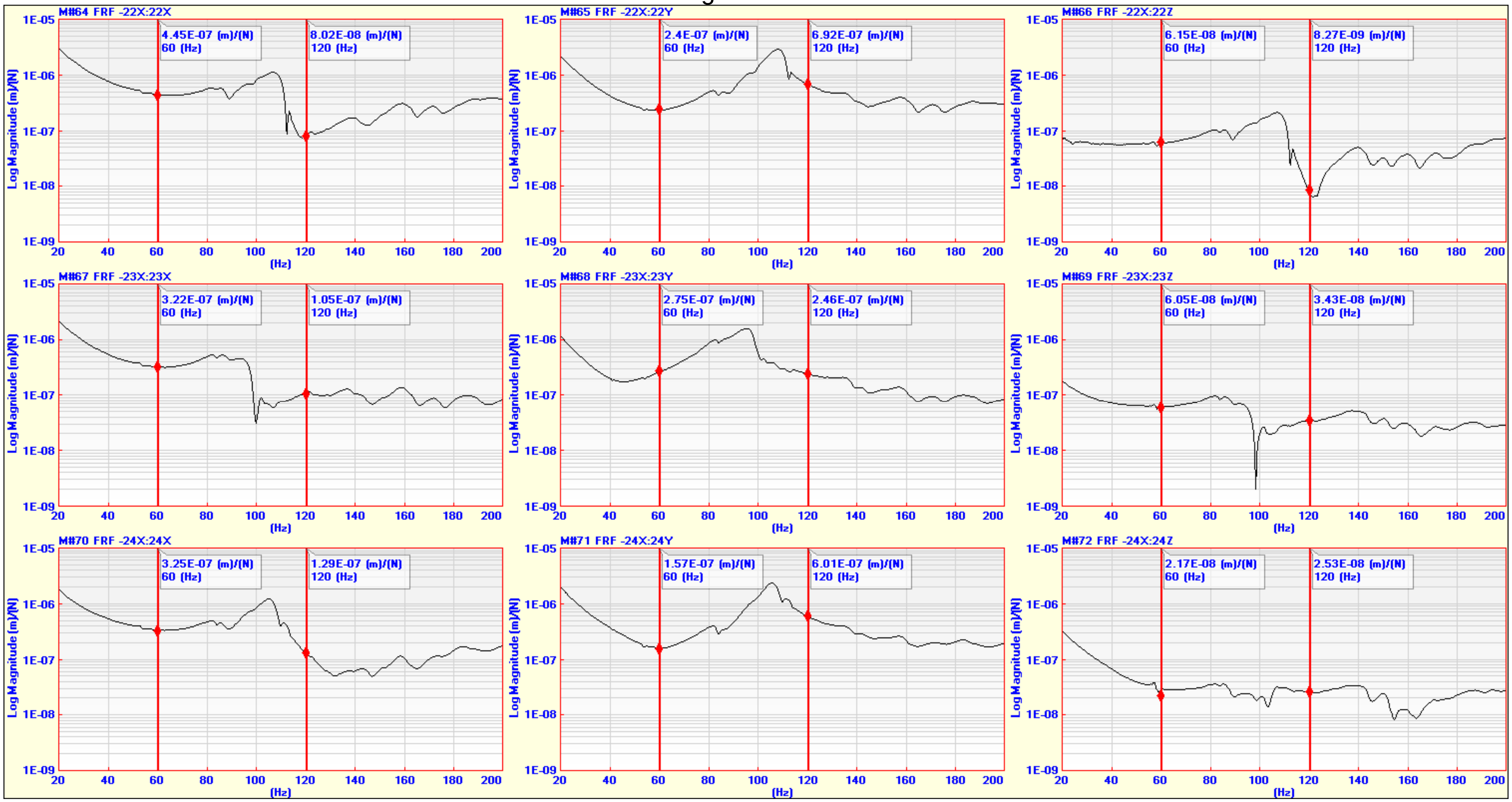

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Figure 18-9 Driving point measurements of DE SERIES CAPS
Cap numbered 25 (top row), Cap numbered 26 (middle row), and Cap numbered 27 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

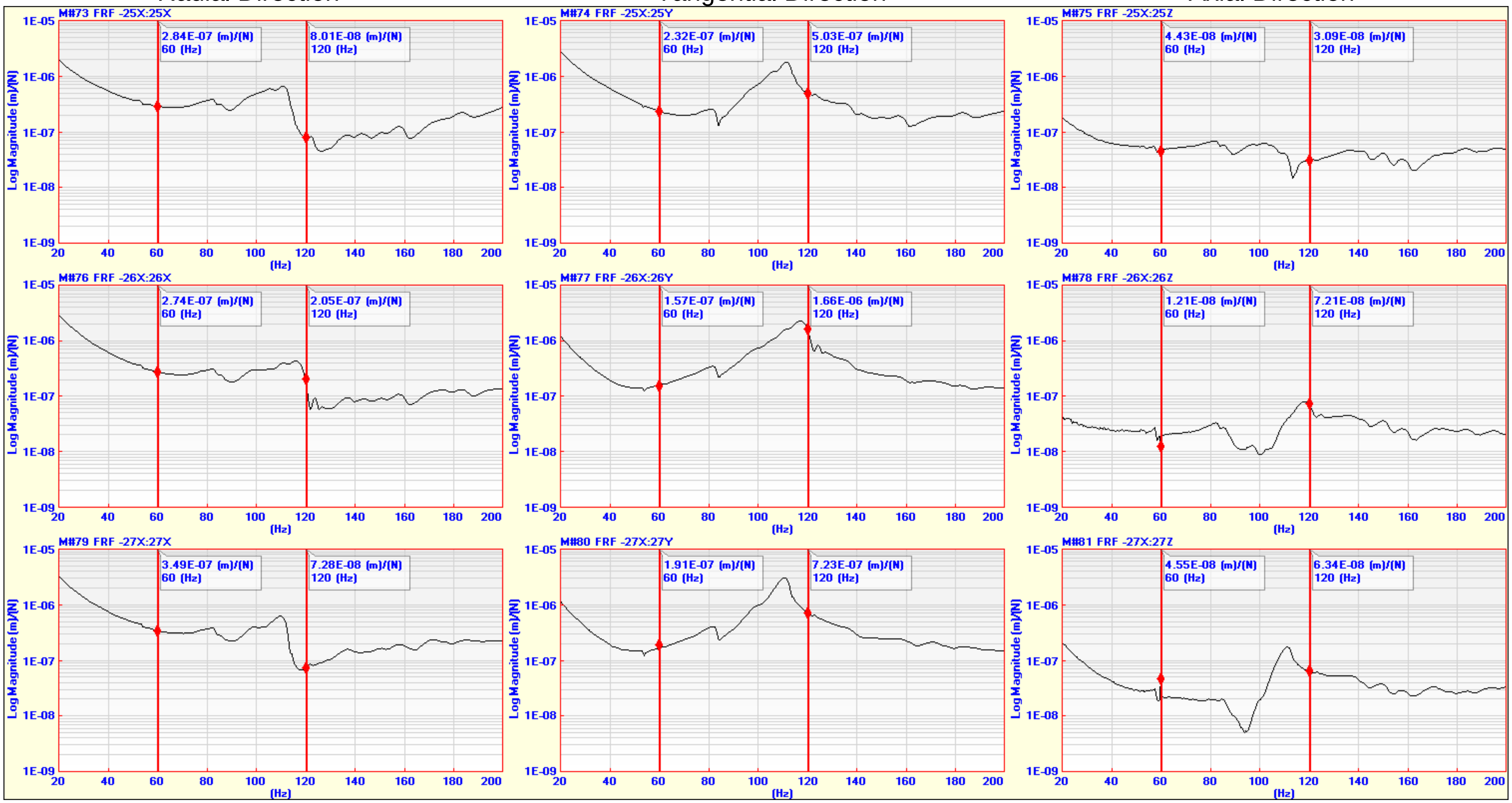

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Figure 18-10 Driving point measurements of DE SERIES CAPS
Cap numbered 28 (top row), Cap numbered 29 (middle row), and Cap numbered 30 (bottom row)

Radial Direction Tangential Direction Axial Direction

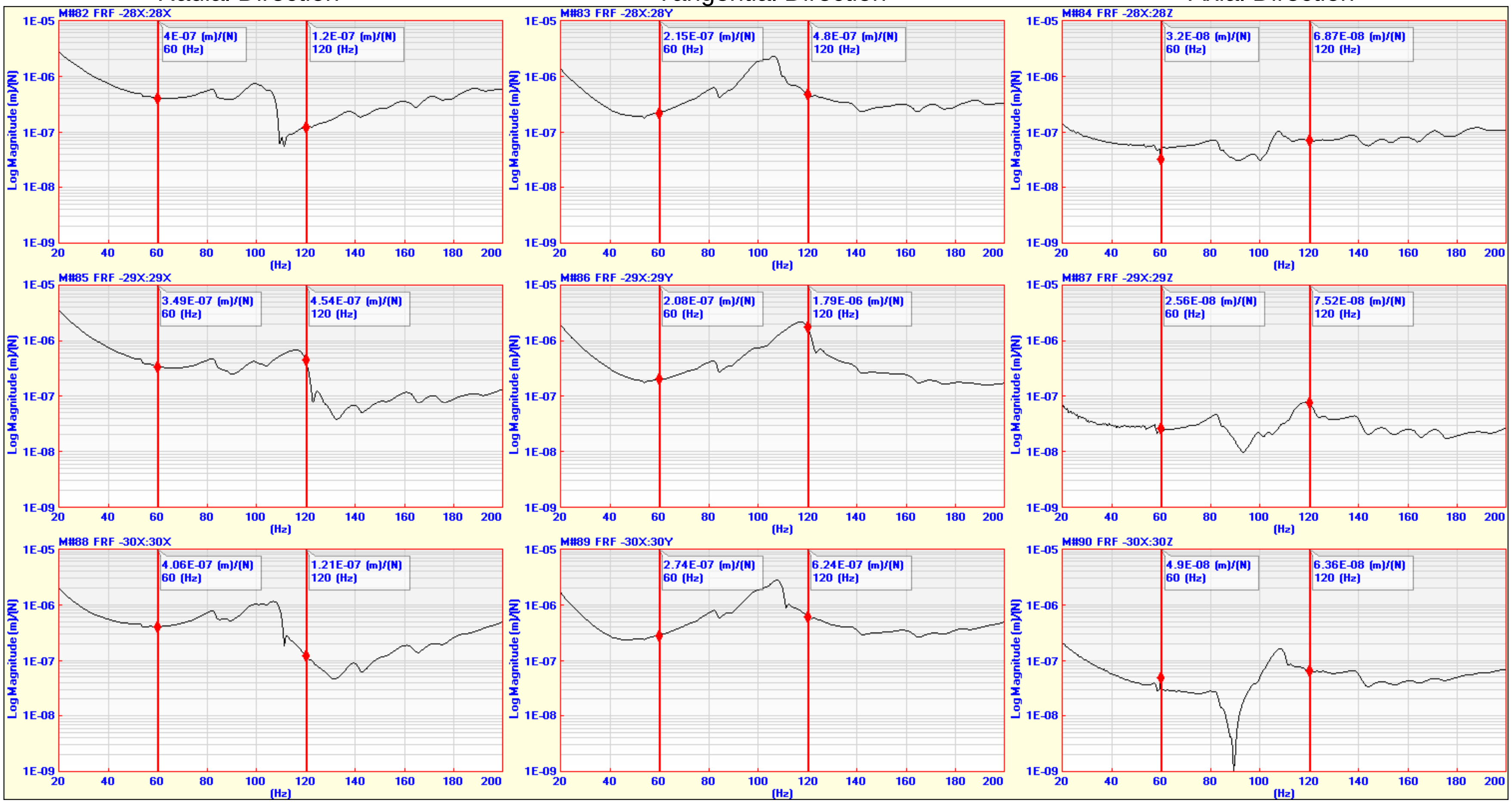

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Figure 18-11 Driving point measurements of DE SERIES CAPS
Cap numbered 31 (top row), Cap numbered 32 (middle row), and Cap numbered 33 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

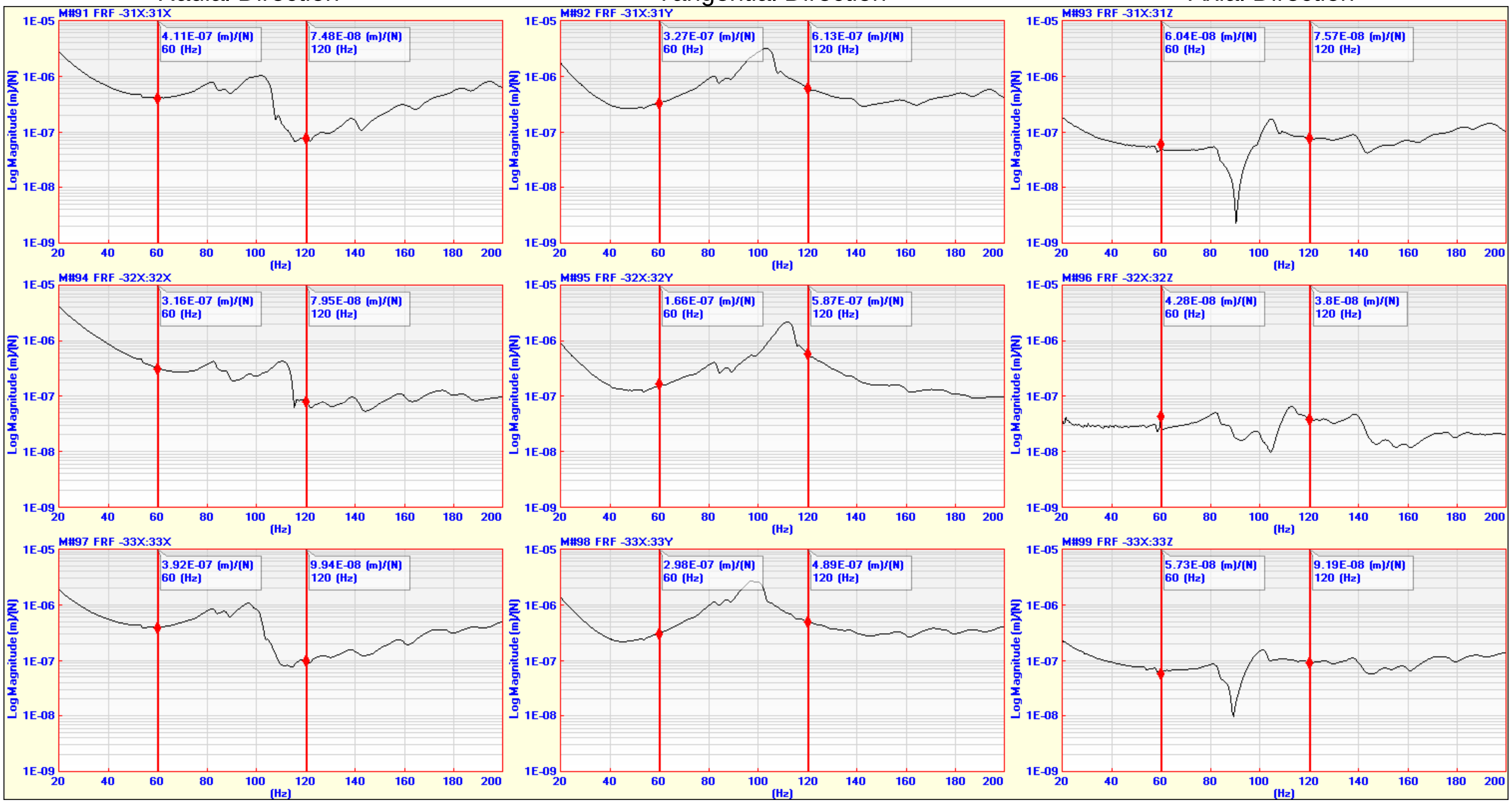

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Figure 18-12 Driving point measurements of DE SERIES CAPS
Cap numbered 34 (top row), Cap numbered 35 (middle row), and Cap numbered 36 (bottom row)
Radial Direction Tangential Direction Axial Direction

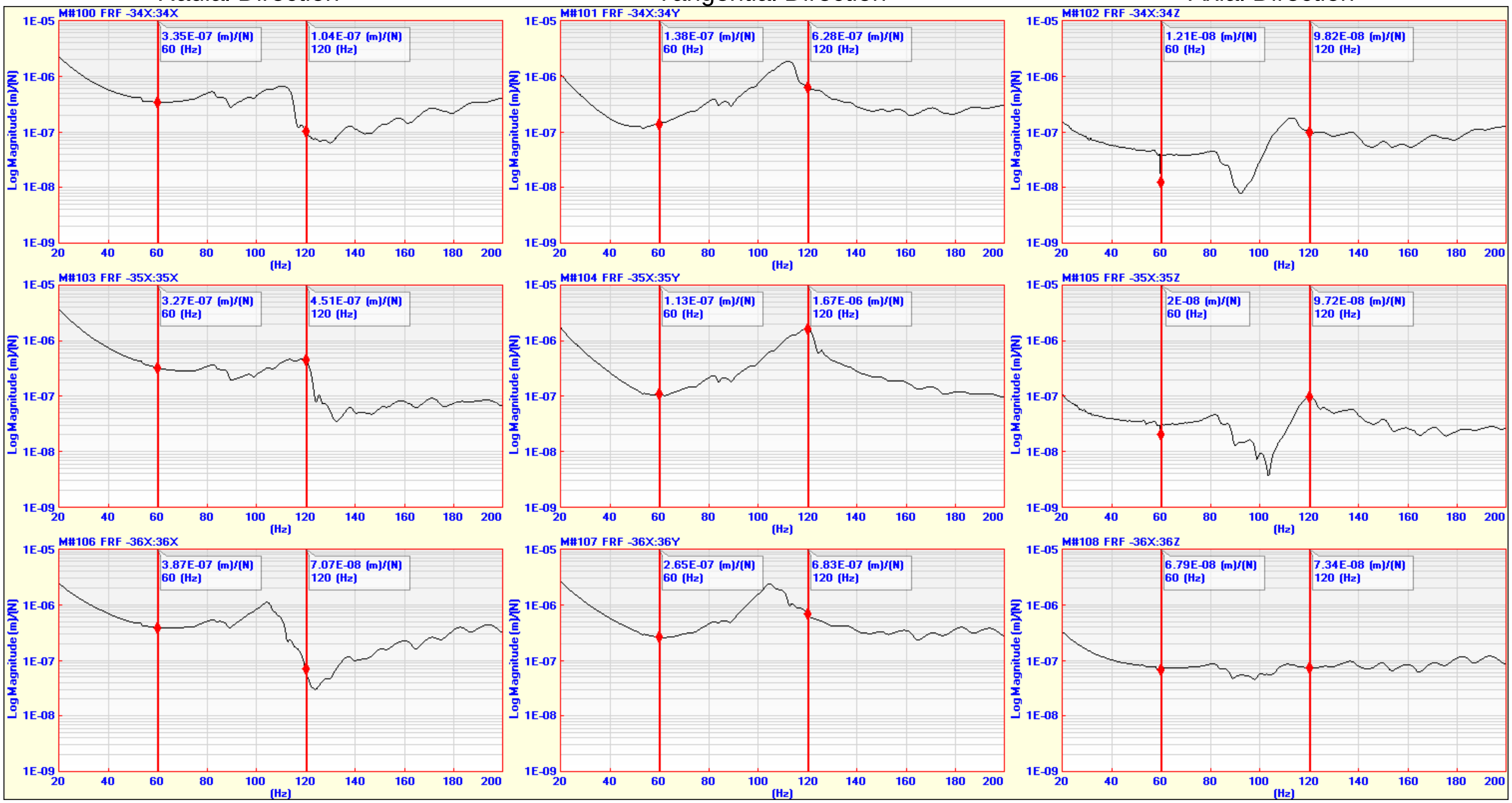

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Figure 18-13 Driving point measurements of DE SERIES CAPS
Cap numbered 37 (top row), Cap numbered 38 (middle row), and Cap numbered 39 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

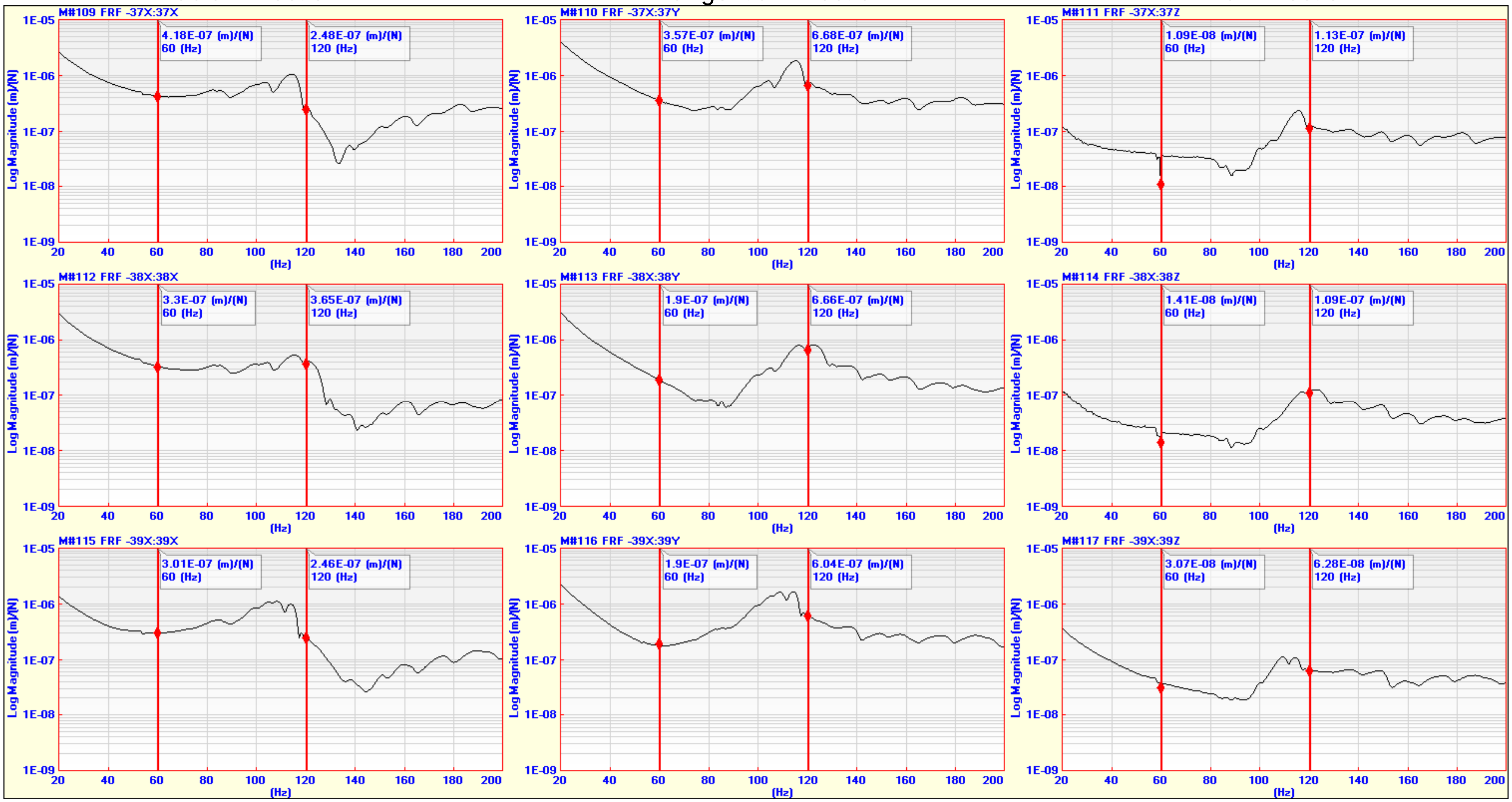

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Figure 18-14 Driving point measurements of DE SERIES CAPS
Cap numbered 40 (top row), Cap numbered 41 (middle row), and Cap numbered 42 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

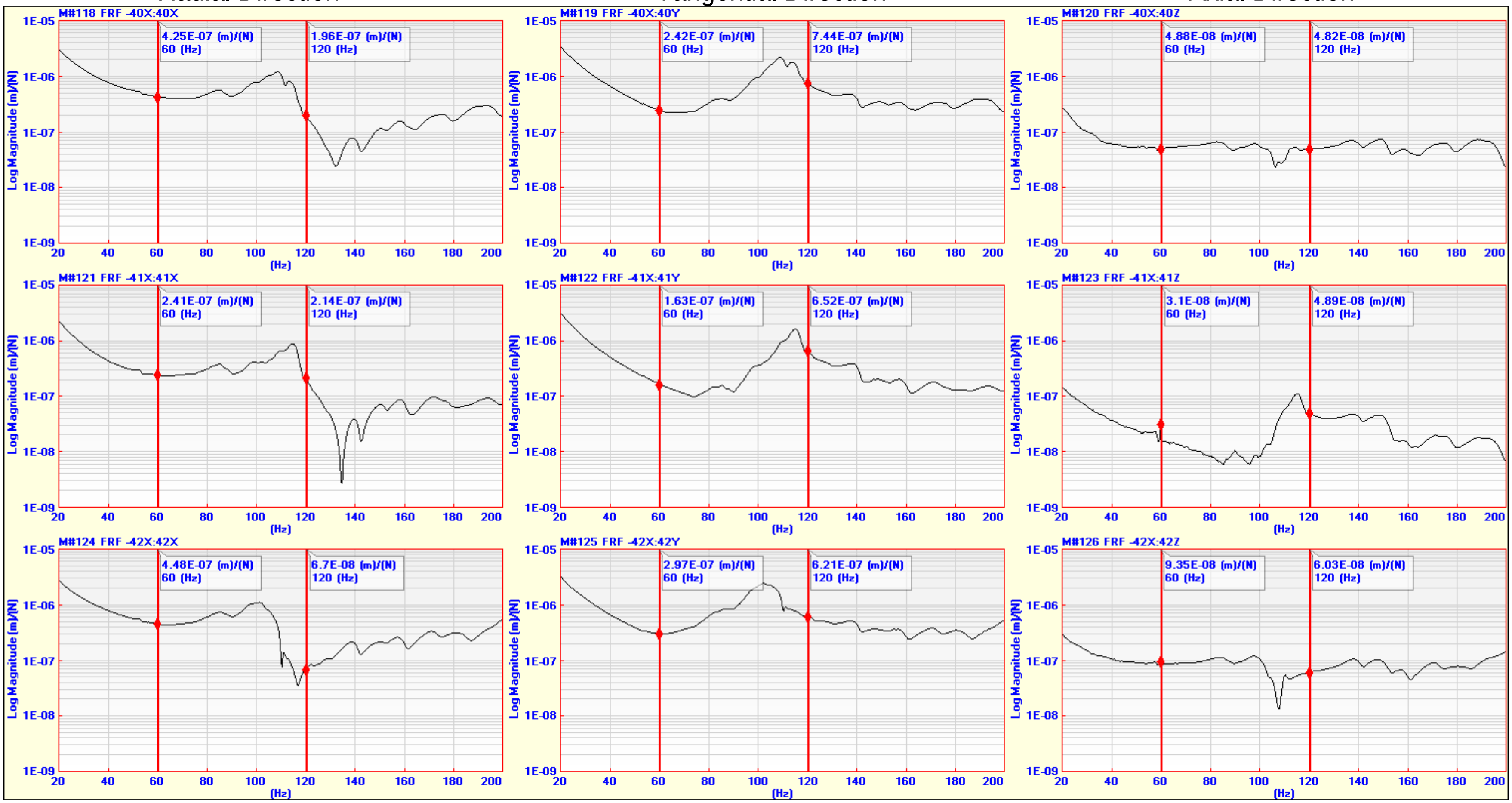

Figure 18-15 Driving point measurements of DE SERIES CAPS
Cap numbered 43 (top row), Cap numbered 44 (middle row), and Cap numbered 45 (bottom row)

Radial Direction Tangential Direction Axial Direction

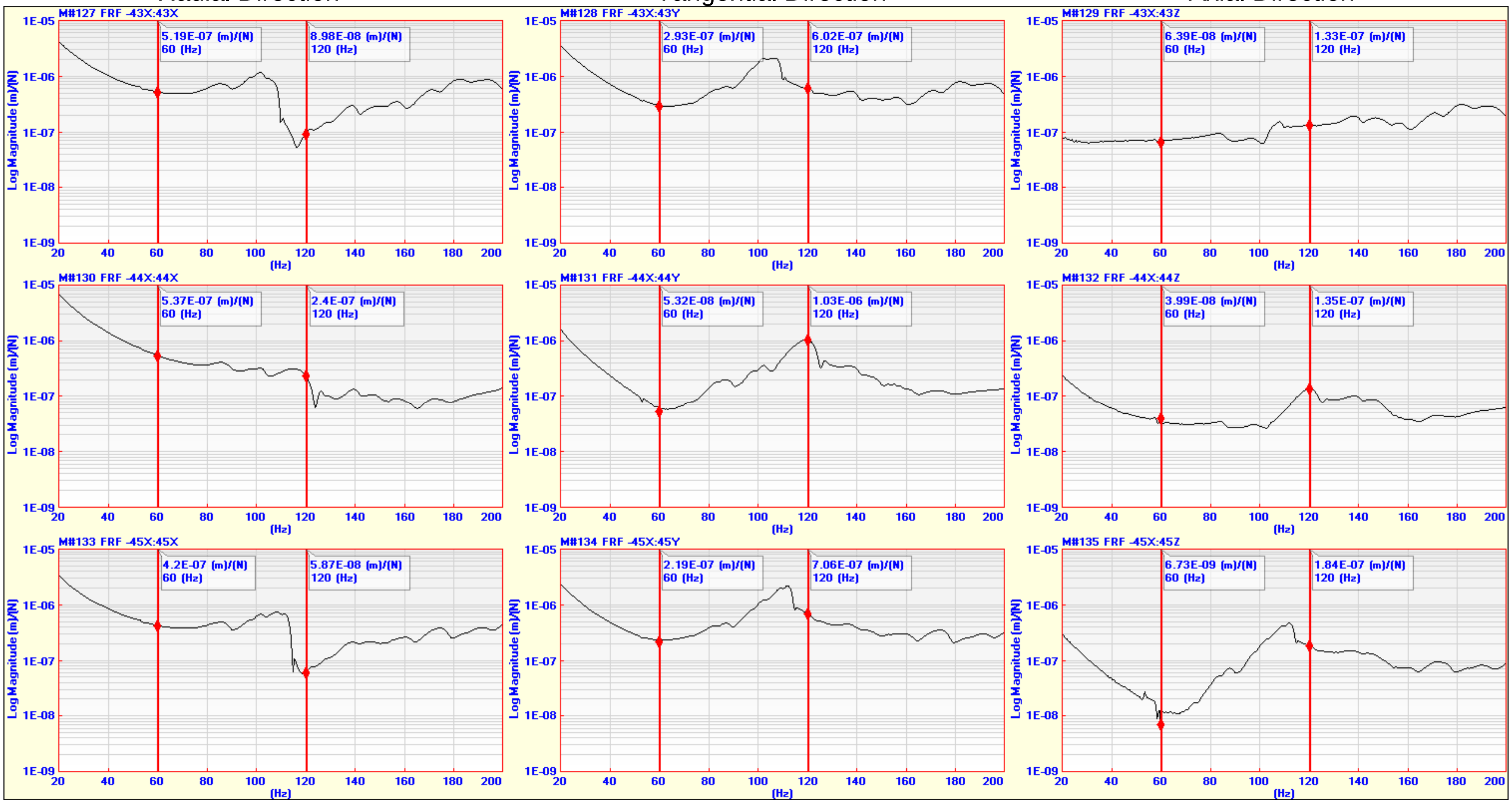

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Figure 18-16 Driving point measurements of DE SERIES CAPS
Cap numbered 46 (top row), Cap numbered 47 (middle row), and Cap numbered 48 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

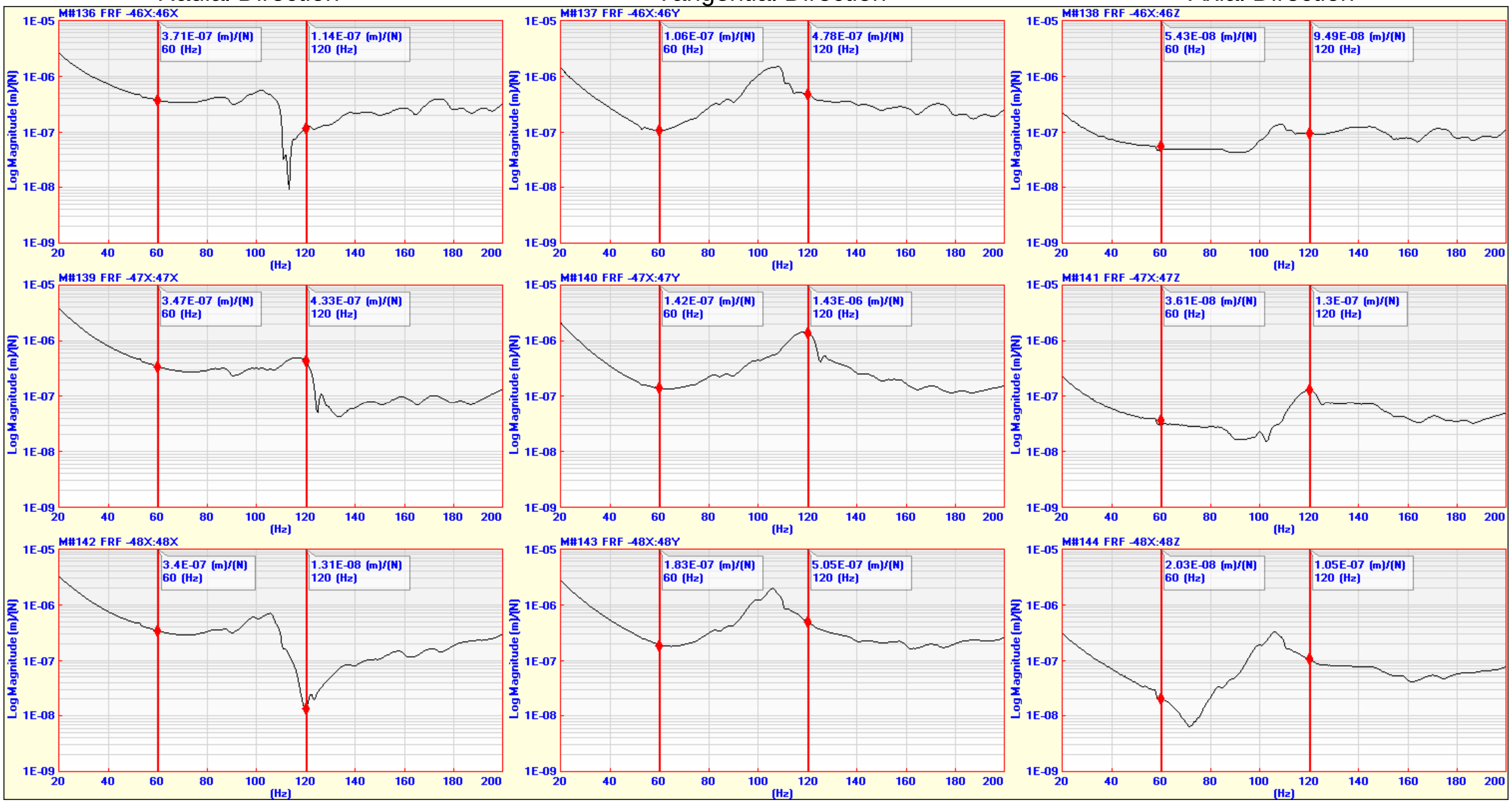

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Figure 18-17 Driving point measurements of DE SERIES CAPS
Cap numbered 49 (top row), Cap numbered 50 (middle row), and Cap numbered 51 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

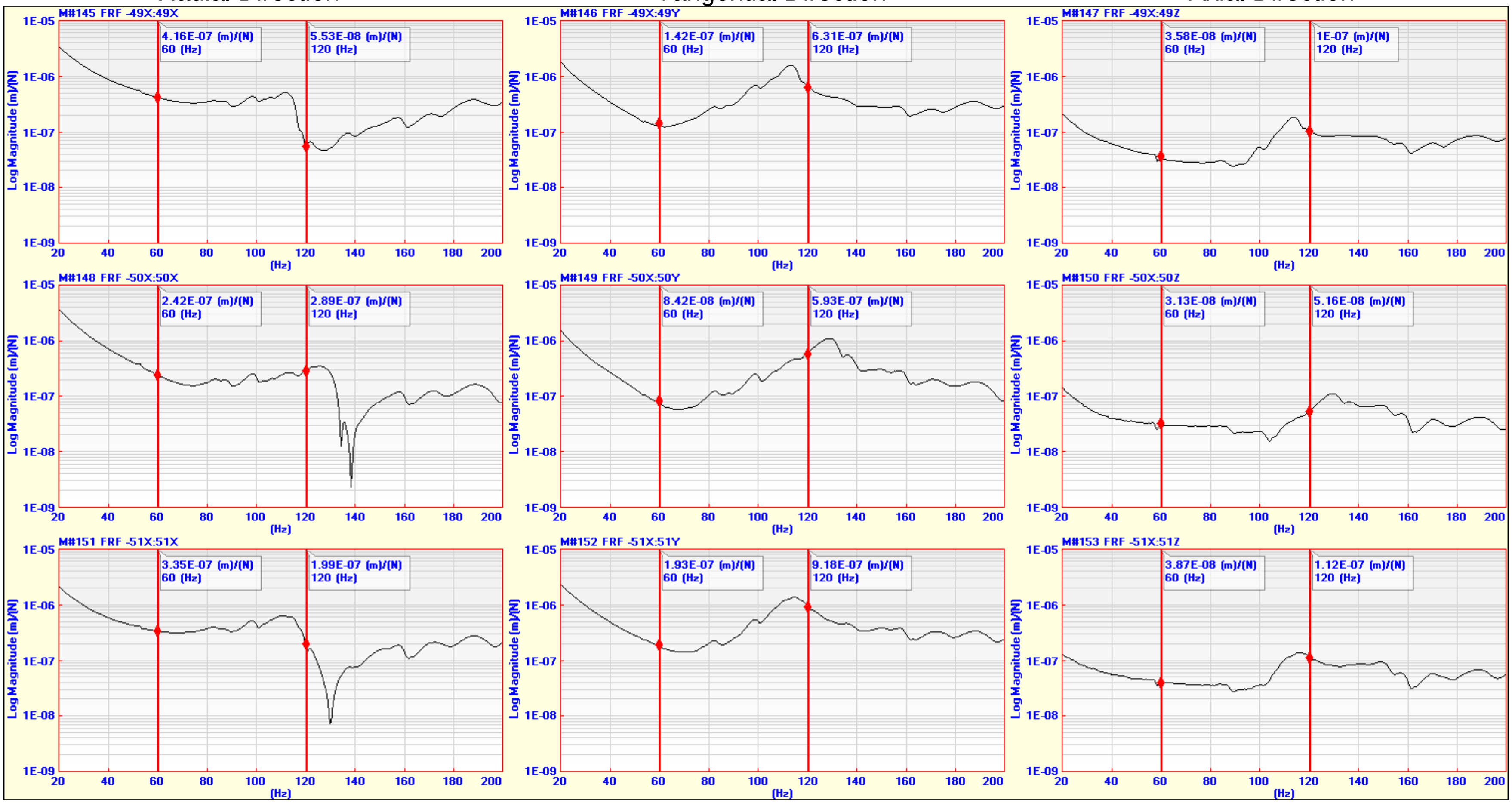

Figure 18-18 Driving point measurements of DE SERIES CAPS
Cap numbered 52 (top row), Cap numbered 53 (middle row), and Cap numbered 54 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

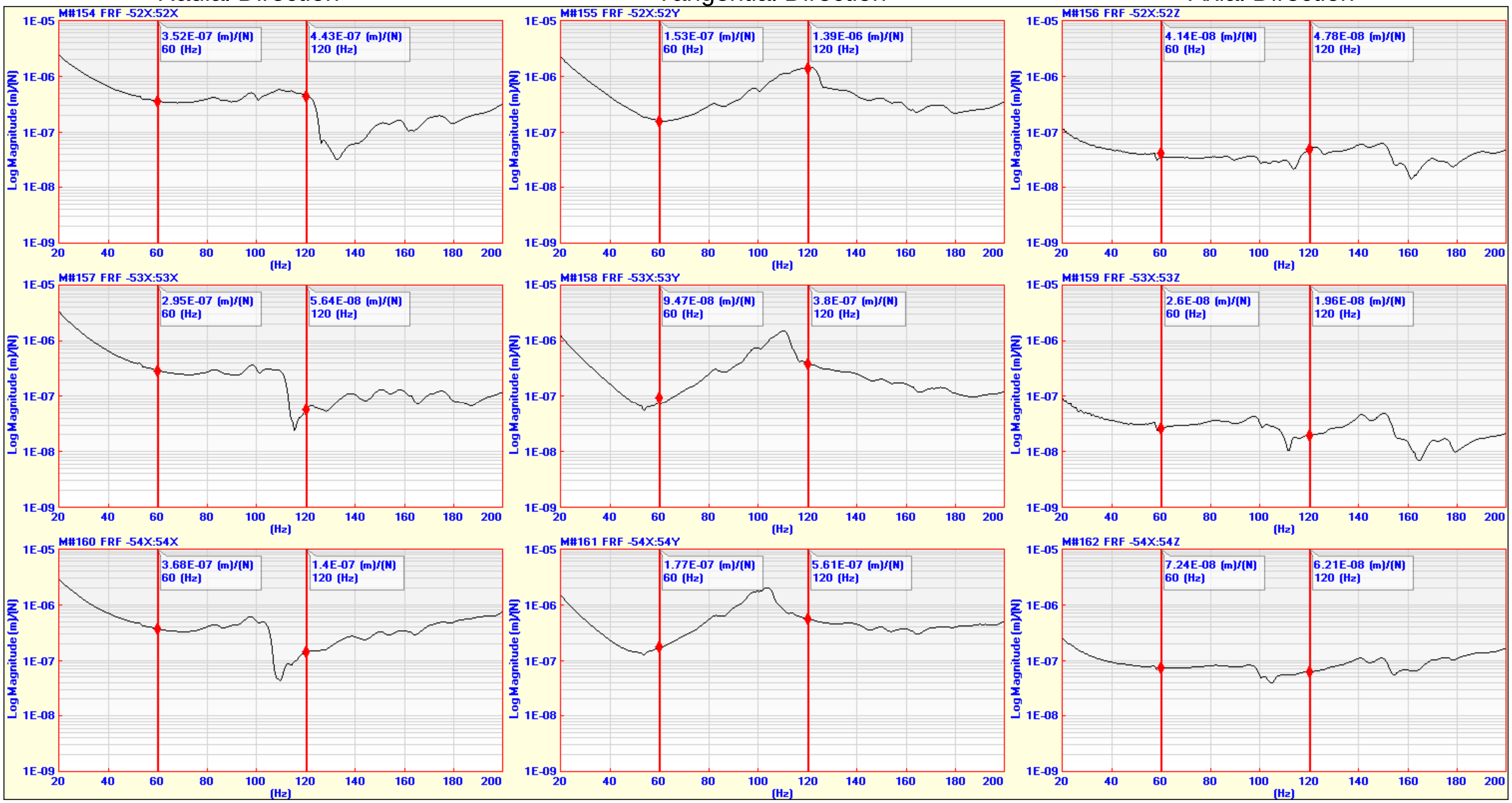

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Figure 18-19 Driving point measurements of DE SERIES CAPS
Cap numbered 55 (top row), Cap numbered 56 (middle row), and Cap numbered 57 (bottom row)
Radial Direction Tangential Direction Axial Direction

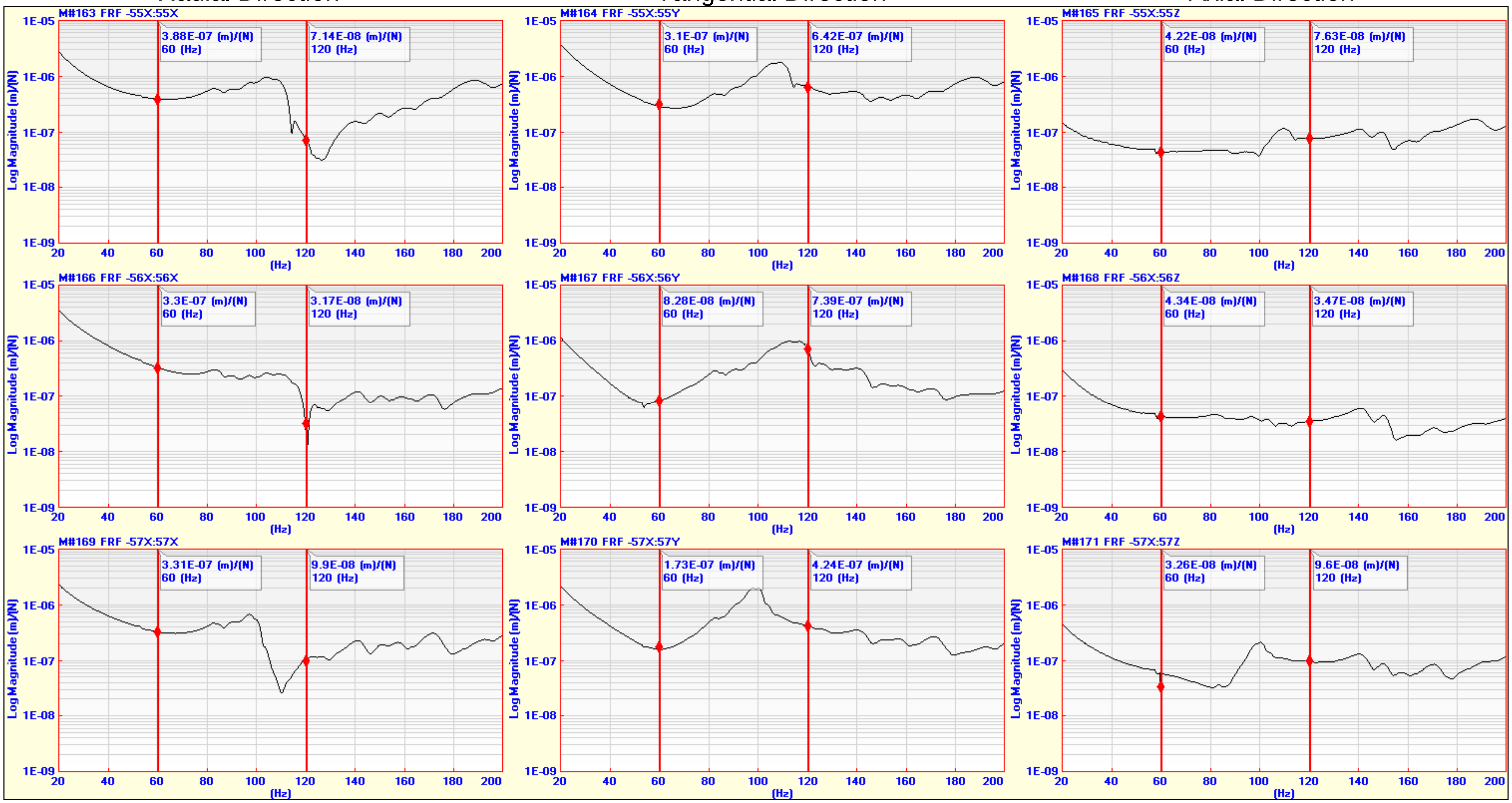

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Figure 18-20 Driving point measurements of DE SERIES CAPS
Cap numbered 58 (top row), Cap numbered 59 (middle row), and Cap numbered 60 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

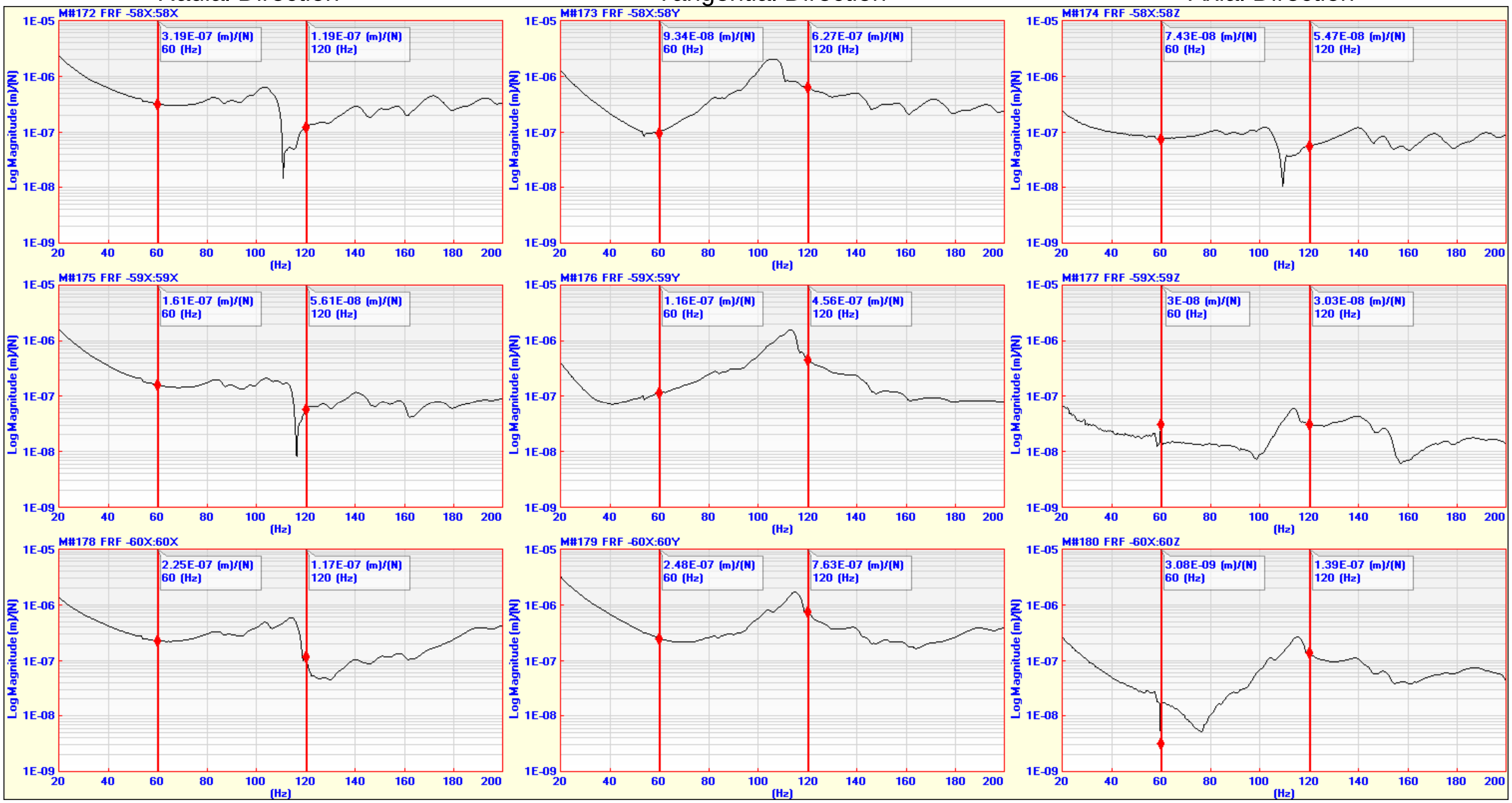

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Figure 18-21 Driving point measurements of DE SERIES CAPS
Cap numbered 61 (top row), Cap numbered 62 (middle row), and Cap numbered 63 (bottom row)

Radial Direction | Tangential Direction | Axial Direction

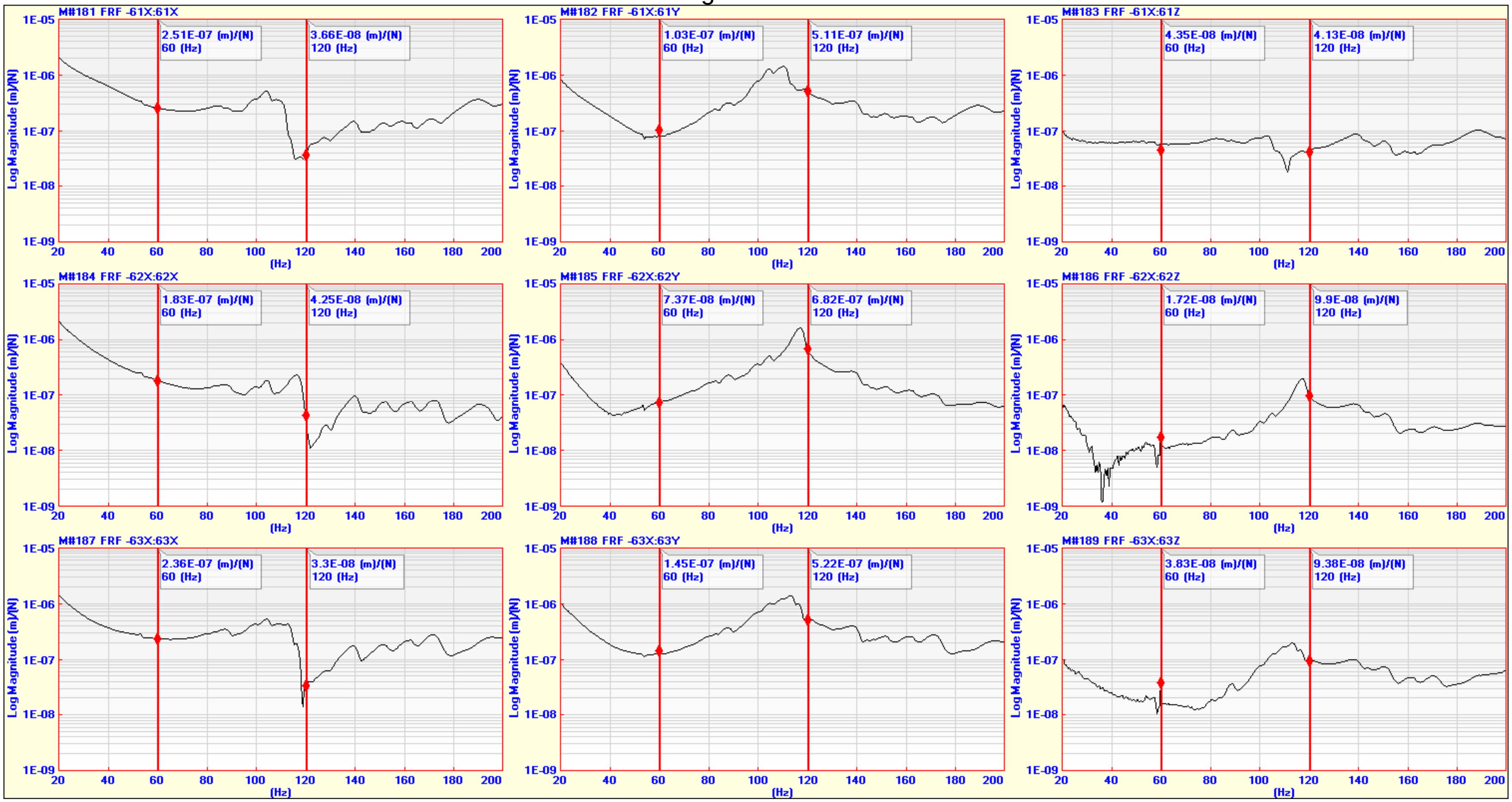

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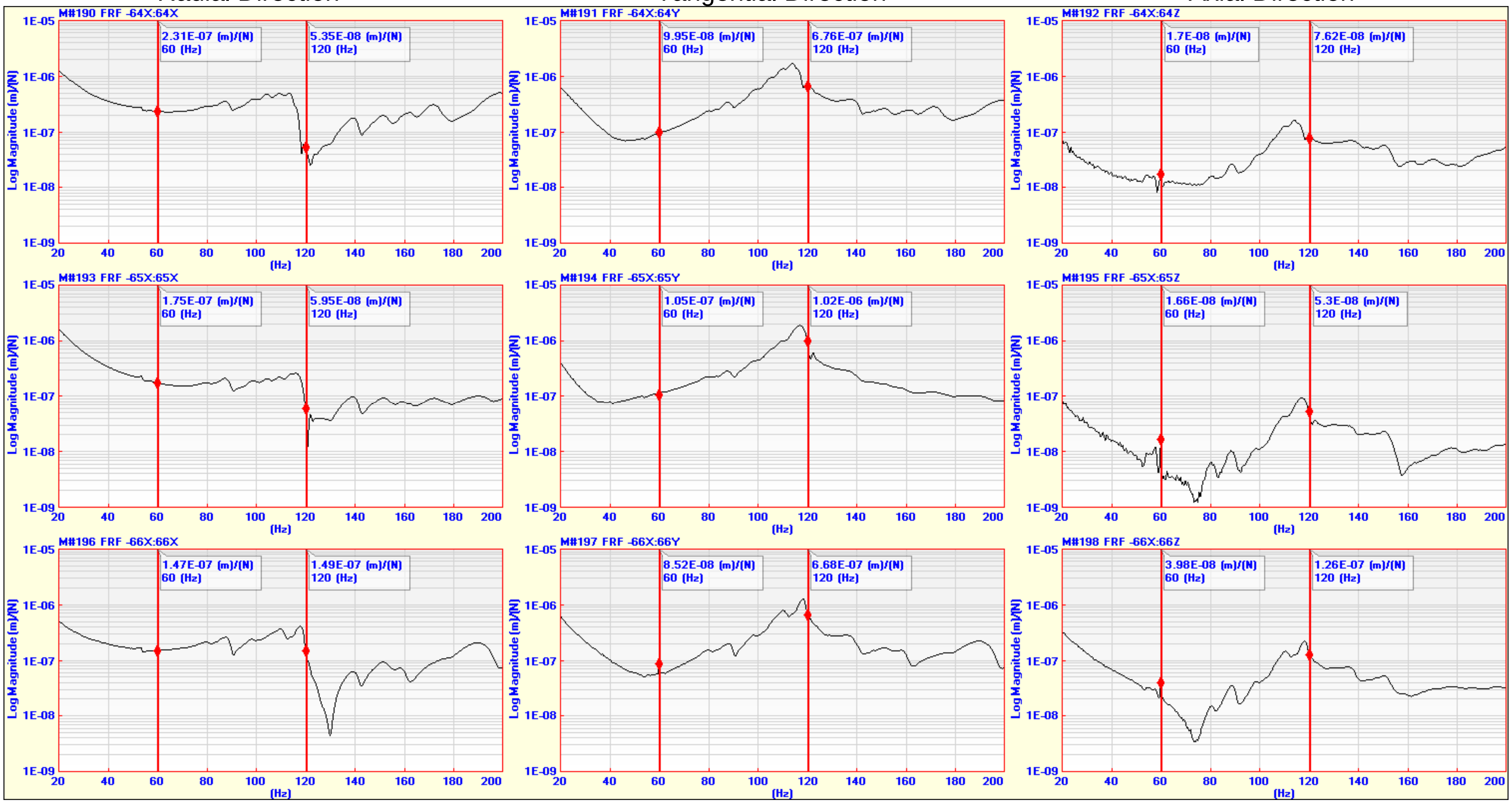
Figure 18-22 Driving point measurements of DE SERIES CAPS
Cap numbered 64 (top row), Cap numbered 65 (middle row), and Cap numbered 66 (bottom row)

Radial Direction | Tangential Direction | Axial Direction



6. Conclusion

During an inspection of the generator, the global modal analyses and the driving point measurements of the series caps of both NDE and DE end windings were performed. The results from the global modal analyses indicated that the frequencies of the 4-node elliptical mode shapes occurred at 72 Hz, 76 Hz, 82 Hz, and 93.5 Hz for the NDE end winding. In the case of the DE end winding, the frequencies of the elliptical mode shapes occurred at 81 Hz, 84 Hz, and 89.5 Hz. All the natural frequencies corresponding to the elliptical mode shapes were well below the critical range of 115 Hz to 135 Hz, and therefore were within ALSTOM acceptance criterion.

The magnitudes of vibration of the driving point measurements of the series caps of the NDE and DE end windings were relatively small in the radial and axial directions (even though the impact was made in the radial direction), however, in the tangential direction, the magnitudes of vibration of some of the caps were more than 5E-7 m/N (500 nm/N) and therefore exceeding ALSTOM acceptance criterion.

The magnitudes of vibration of the phase connections and their corresponding phase arms in the radial and axial directions were also relatively small, but the magnitudes of vibration for some of the phase connections in the tangential direction were greater than 5E-7 m/N (500 nm/N) and therefore exceeding ALSTOM acceptance criterion.

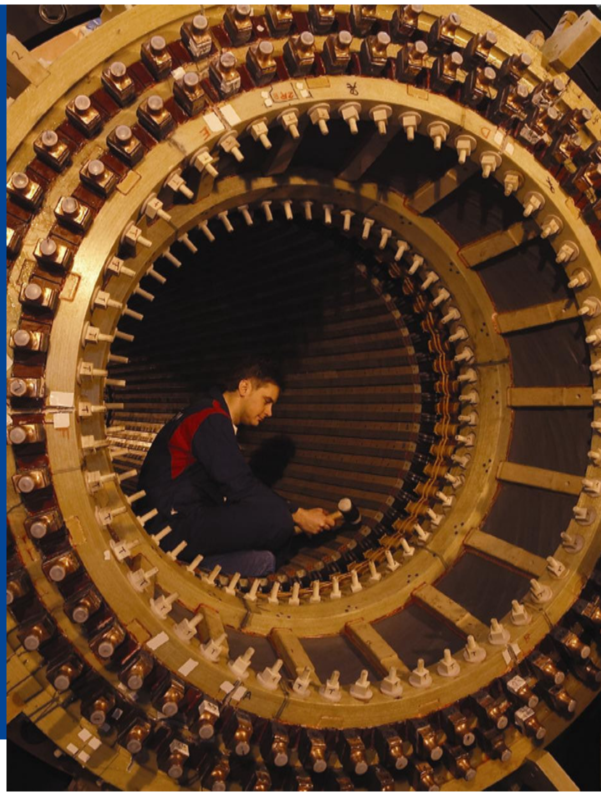
The characteristic of the end windings would change over time since the end windings are subjected to the mechanical and thermal stresses during start-stops and operation. Hence the magnitudes of vibration may increase and the natural frequencies may shift to the critical range. Therefore, ALSTOM recommends that the bump testing of the end windings be repeated during next opportunity.

Generator Diagnostics

GENERATOR SHUTDOWN TEST REPORT

HOLYROOD UNIT 1 MAY 2012

S481/12/054



POWER
THERMAL SERVICES
United Kingdom

ALSTOM

newfoundland labrador hydro
a nalcor energy company

HOLYROOD POWER PLANT

ALSTOM PROJECT NO. 9PS01599

Written By:

David Smith
Engineer, Generator Diagnostics

Approved By:

William Kimberlee
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Mr.A.Lumley	(ALSTOM UK – Manager Condition Monitoring)
Central File	

1. ASSESSMENT SUMMARY

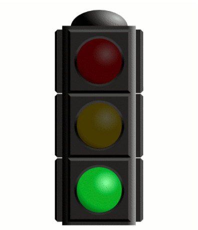
This report details the measurements carried out on the 2nd & 4th of May 2012 at Holyrood Power Plant by Mr David Smith of Alstom Power Generator Diagnostics UK.

Unit 1

These shut down tests are part of a planned outage.
The outage is due to start approximately two weeks after this test date, with a major inspection planned.

After failed starts of the turbine being put down to the burner control system valves the unit was finally run up to rated speed.
RSO (Repetitive Surge Oscillograph) measurements were taken from FSNL (Full Speed No Load 3600RPM) to barring speed, checking the performance characteristic of the rotor windings as the centrifugal forces reduced.

The client has reported an increase in vibration levels on bearing number 4 which relates to the FE of the generator, it also seems that there has been an increased excitation required to achieve rated output from the rotor. Studying the data this increase doesn't seem to be consistent for the generation period & therefore indicating that there is not a current carrying fault.
The insulation resistance test performed on the rotor showed no issues present with respect to the rotor windings & the rotor body (earth)



The RSO measurements taken at 3600 RPM no load and down to barring, show very minor indications of an inter turn fault being present. These levels are within the Alstom specifications.

2. CONCLUSIONS AND RECOMMENDATIONS

Perform during the retaining ring removal RSO tests, prior to removal, during the inspection with the retaining rings removed (this will be different but just checking for interturn shorts), again when the retaining rings have been re-installed and finally when the rotor has been placed back onto it's bearings during the re-build.
Examination of the shaft showed the activity of electro erosion present. This can be put down to a poor contact surface or a poor earth path.
It was noted that there isn't a direct earth path, this system entrusts the bolted circuit that the earth brackets are held on with instead of a direct wire method.
Installation of the braid shaft earthing should be made on the during this outage.
Perform shaft voltage measurements at regular intervals and load points.
Included in the additional information section is a new diagnostic test (SFRA) Alstom UK now offers, this we recommend to be included every three years on minor inspections only access required is to the output terminals.
Also included is a small over view on monitoring options available for the generator also information on shaft voltages & the background.
Perform run out checks & clean the excitation slip rings.
Inspect bearings 4 & 5 for any damage or excessive wear.
Keep performing inspections as per exsisting schedules & any problems encountered contact Alstom for any support required.

3. REFERENCES

Due to the maintenance & outage work being recently handed over to Alstom (including the turbines).
There are no previous records for work undertaken or a machine history database; these tests & future work will form a foundation for the machine history records, thus creating traceable records.

4. IDENTIFICATION OF THE GENERATOR

CUSTOMER	Newfoundland and Labrador Hydro	
PLANT	Holyrood	
UNIT ID	1	
GENERATOR MANUFACTURER	CANADIAN GENERAL ELECTRIC	(1969)
GENERATOR TYPE	N/A	
ROTOR FIELD VOLTAGE	375 V	
ROTOR FIELD CURRENT	1864 A	
STATOR SERIAL NUMBER	980485	
STATOR VOLTAGE	16.0 KV	
STATOR CURRENT	7016 A	
STATOR INSULATION CLASS	N/A	
RATED OUTPUT	194,445 KVA	
FREQUENCY	60 HZ	
CONNECTION	STAR	
SPEED	3600 RPM	
COOLING SYSTEM	HYDROGEN	
POWER FACTOR	0.90	
OPERATING HOURS	178169.0	(1969- PRESENT)
NO OF STARTS	270	(1990 – PRESENT)
NO OF TRIPS	166	(1990 – PRESENT)

5. DISCUSSIONS

RSO

RSO (Re-current Surge Oscillograph) tests were carried out on the rotor winding with the shaft at rated speed. Following the trip of the unit, measurement were repeated during rundown to barring speed.

The test consists of injecting pulses simultaneously into both ends of the rotor winding via the slip rings. The two injected signals are displayed as an oscillograph. Any differences in the two traces represent a mismatched rotor winding surge impedance, indicating a discontinuity in the rotor winding.

The signal waveforms are analysed and displayed using an ADC unit and laptop computer.

The station employed the recommended 45° two brush per slip ring system.
Insulated brushes were made up for this particular test & will be kept for future RSO tests at speed.

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6. TEST RESULTS

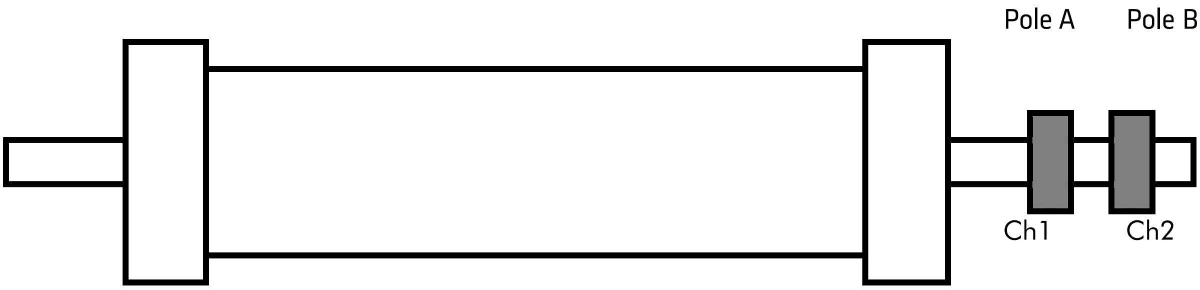
RSO

Condition during test: 01
Insert condition code

Remarks: Holyrood 3600 RPM Unit 1 FSNL
Speed during test and detailed state of disassembly

Condition Codes:

01 = Generator at nominal speed, 02 = Generator at other speeds (see remarks), 03 = Generator at standstill but housing is closed, 04 = Generator at standstill and housing is opened, 05 = Rotor is removed but still complete, 06 = Rotor is partially or complete disassembled (details see Remarks)



Remarks: As per above diagram
Special slip ring arrangements and connections on disassembled rotor

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs
Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs
Picture 3	RSO results, Channel 1 and Channel 2, traces separated, time base 5µs
Picture 4	RSO results, Channel 1 and Channel 2, pulse propagation time 10µs

Interturn short circuit is present: N   Yes = Y; No = N

Remarks: Minor deviations present toward the end of the windings
Insert shorted coils if known or other comments regarding the taken decision

Vibration behaviour: 2   1 = normal; 2= suspicious; 3 = > alarm level; 4 = > trip level

Remarks: Vibrations observed are elevated but not at trip levels only on bearing 4
Insert vibration levels, dependencey on excitation current or reference to other measurements

Equipment used: Oscilloscope: Handyscope/ 23221 / cal due 02/03/2013
Type/number/valid until

Pulse generator: Stafford Sig Gen / 0604-007 / Cal Due 24/05/2012
Type/number/valid until

Matching resistance: RV1 49.2 ,RV2 50.6
Setting (Ohm)

Performed by: David, Smith
First name, surname

Date / time: 2012/05/04
YYYY-MM-DD-hh:mm

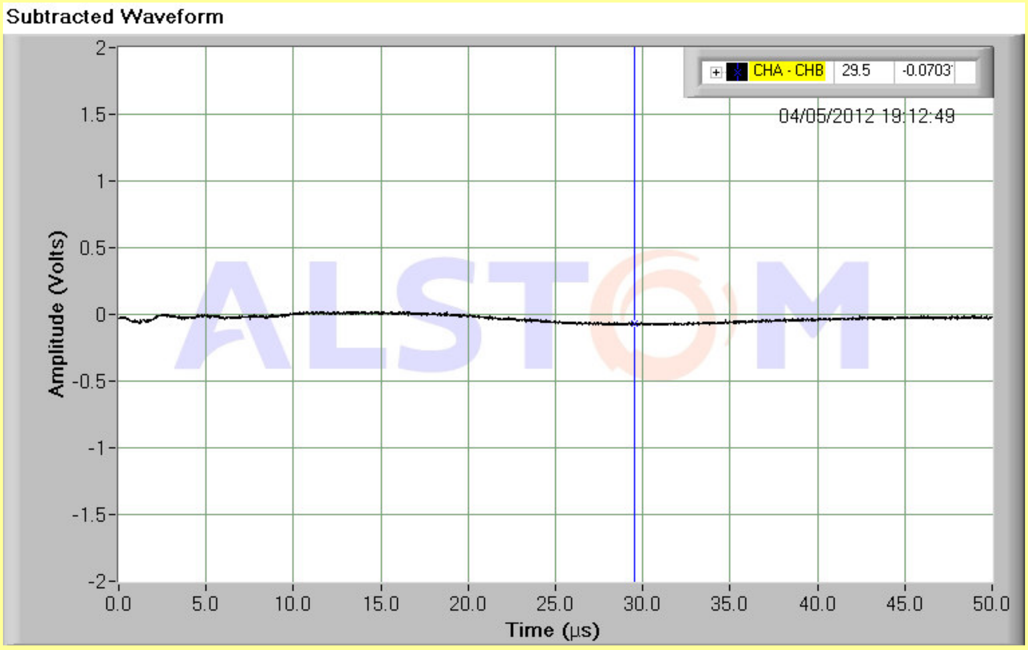
Decision: [X] Pass   [ ] To be confirmed   [ ] Failed

Remarks: Shaft earth contact surface not in good condition, slip rings show signs of ghosting other surface debris.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 1	S481/12/054A	A1	1	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



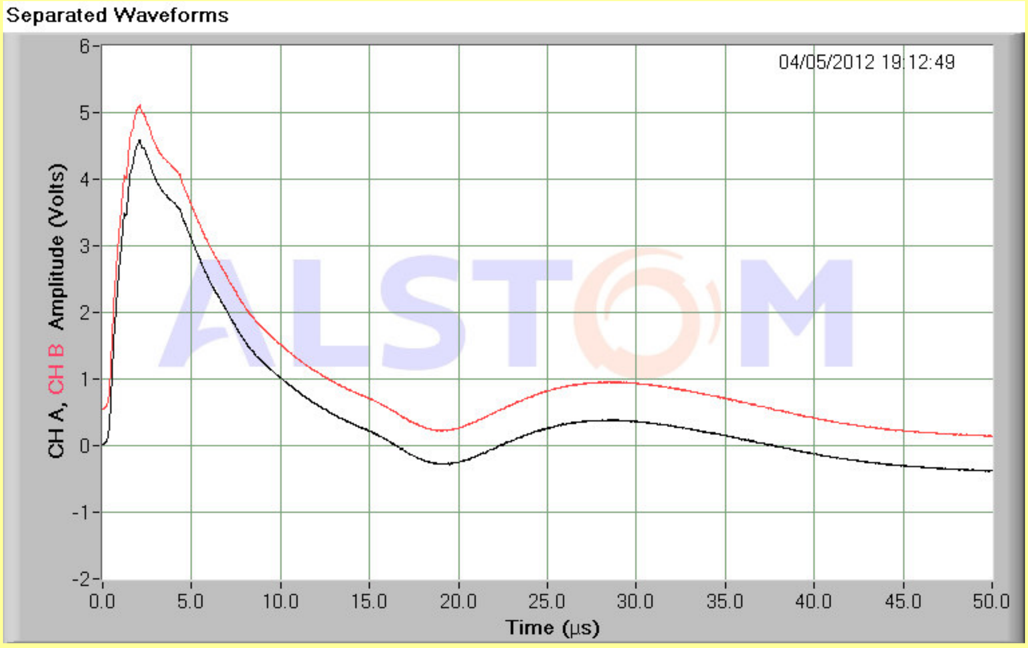
Condition during test: 01
Insert condition code

Remarks: Holyrood 3600 RPM Unit 1
Speed during test and detailed state of disassembly

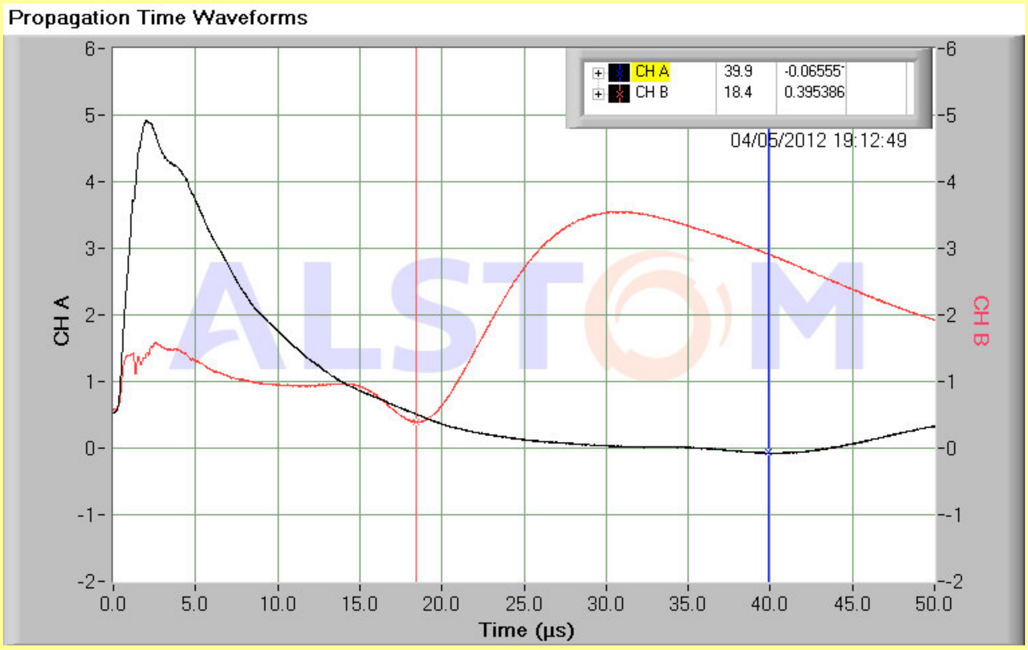
For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 1	S481/12/054A	A2	2	12

Picture 3	RSO results, Channel 1 and Channel 2, traces separated, time base 5µs.



Picture 4	RSO results, Channel 1 and Channel 2, pulse propagation time, time base 10µs



Condition during test: 01
Insert condition code

Remarks: Holyrood 3600 RPM Unit 1
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 1	S481/12/054A	A3	3	12

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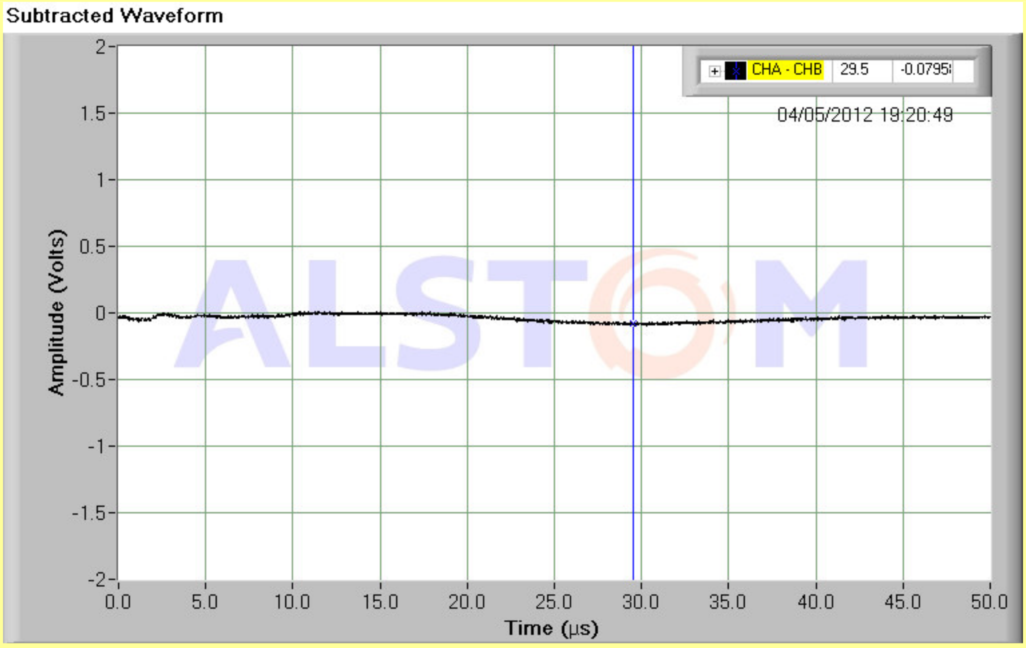
Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02

Insert condition code

Remarks: Holyrood 3000 RPM Unit 1
RV1 49.2 ,RV2 50.6

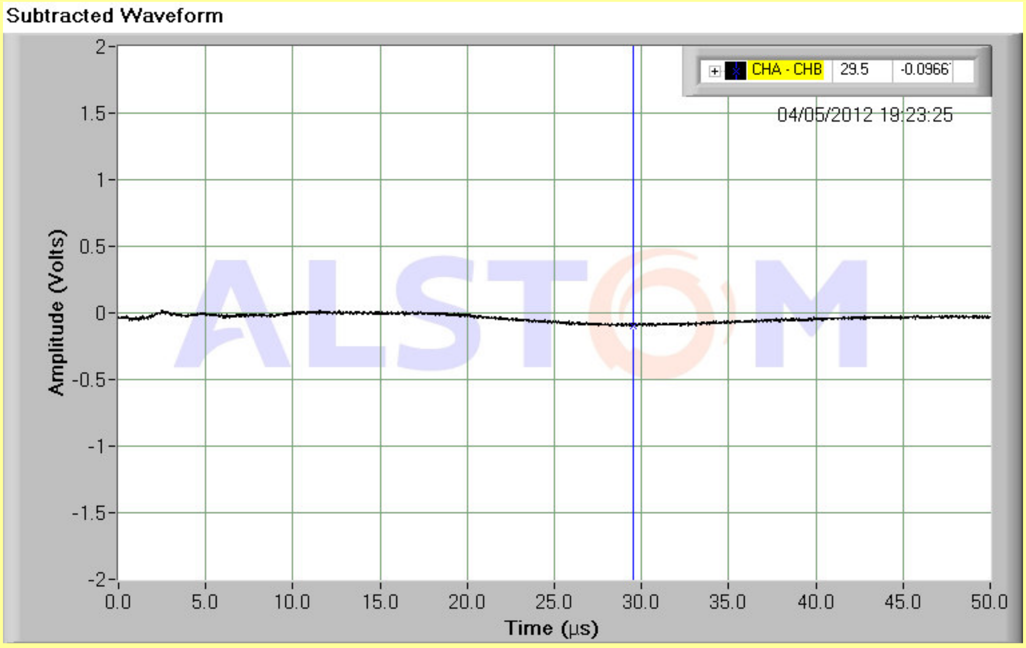
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 1	S481/12/054A	B	4	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02
Insert condition code

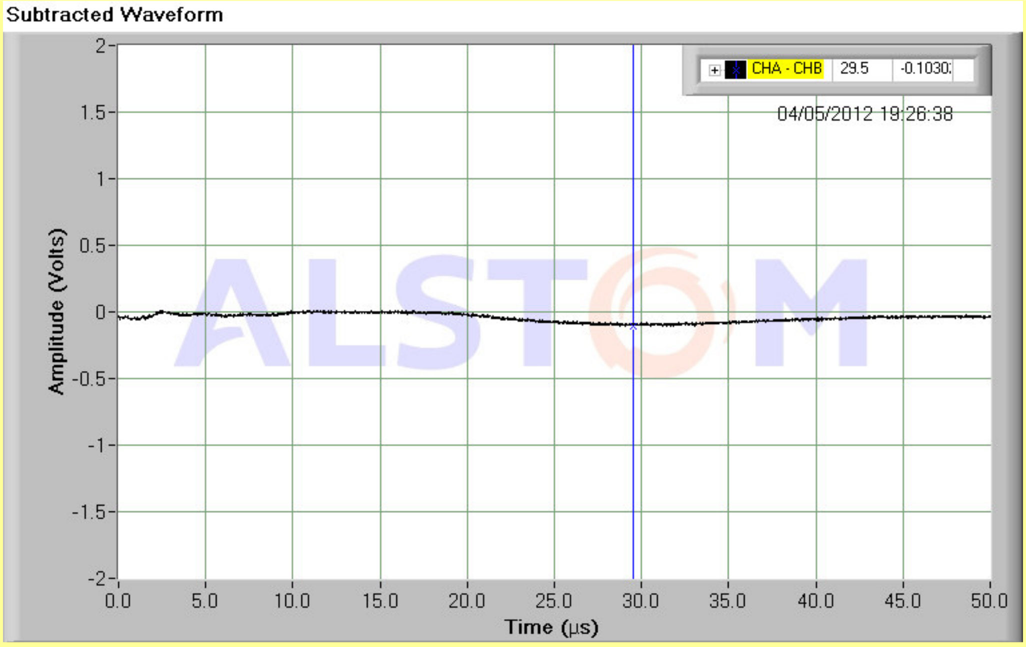
Remarks:
U1 2500 RPM
RV1 49.2 ,RV2 51.0
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 1	S481/12/054A	C	5	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02
Insert condition code

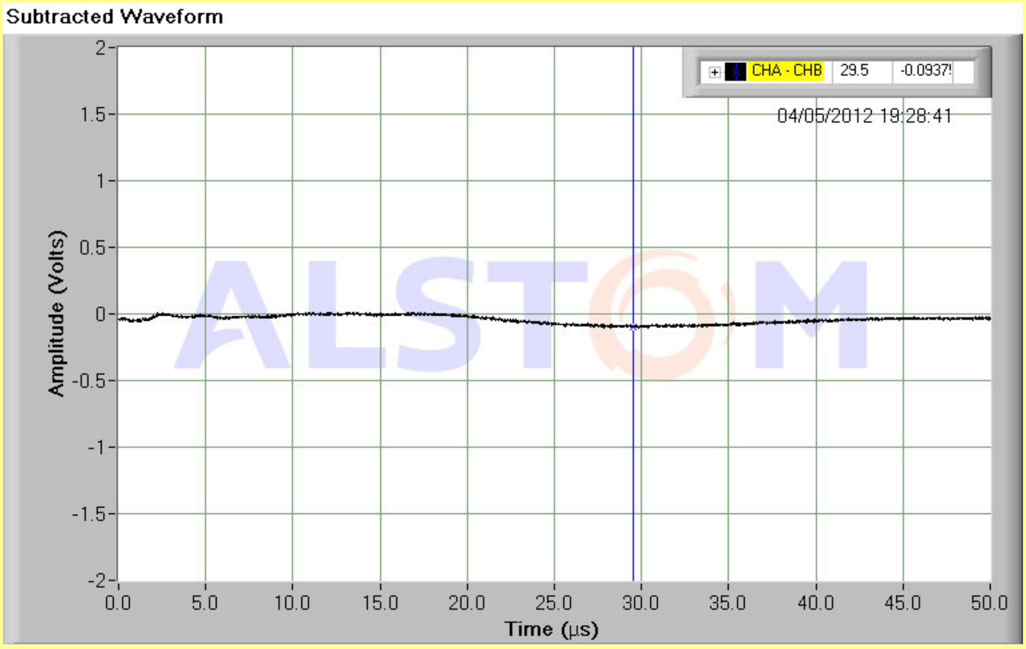
Remarks: Holyrood 2000 RPM Unit 1
RV1 49.2 ,RV2 51.0
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 1	S481/12/054A	D	6	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5μs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5μs.



Condition during test: 02

Insert condition code

Remarks: Holyrood 1500 RPM Unit 1
RV1 49.2 ,RV2 51.0

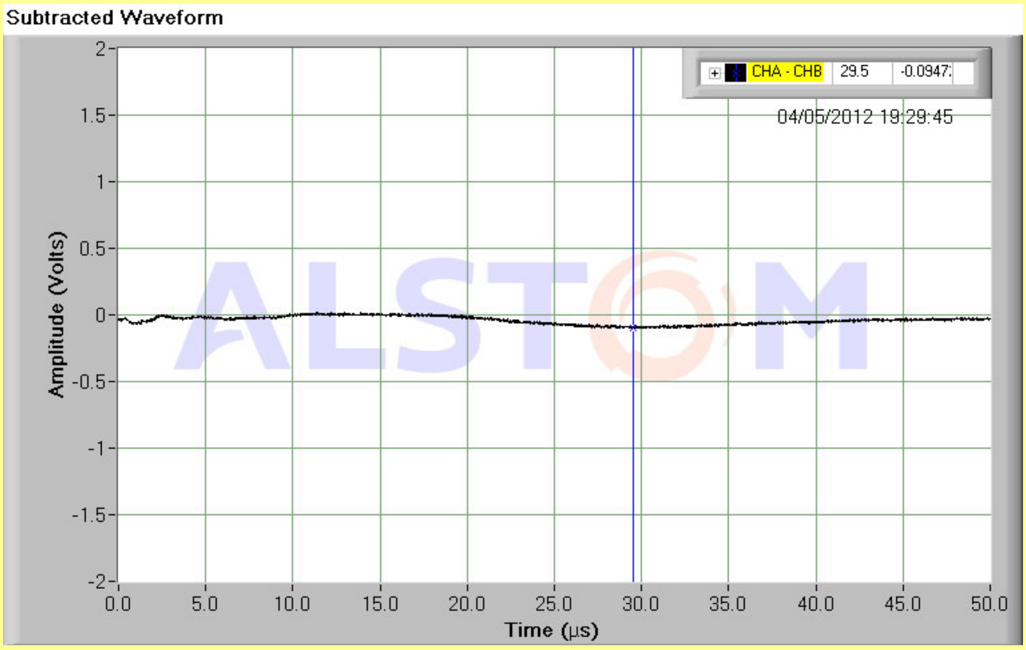
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 1	S481/12/054A	E	7	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02
Insert condition code

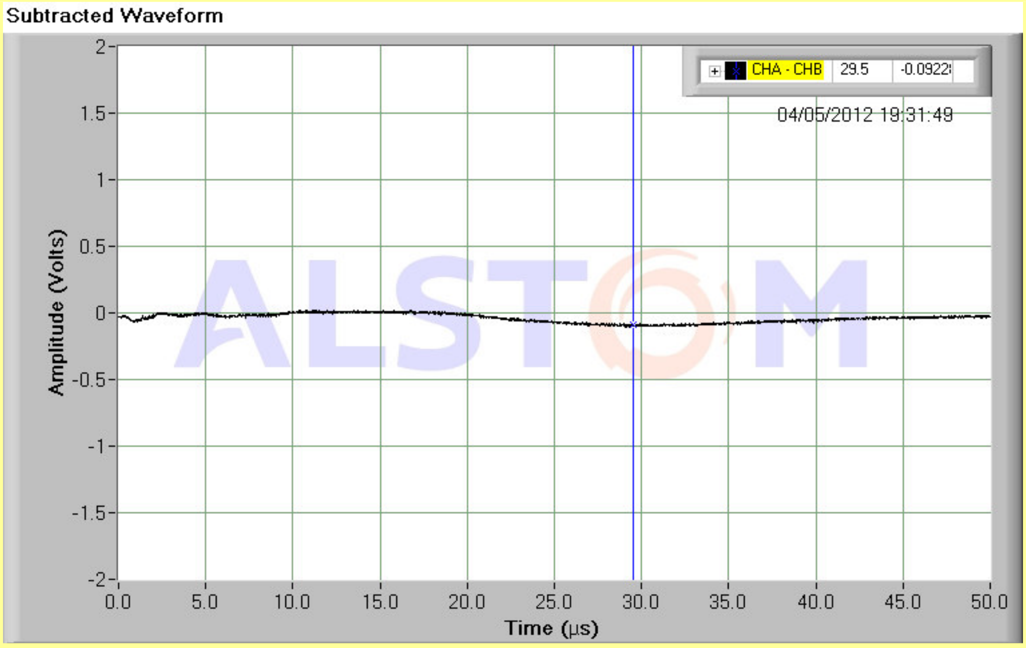
Remarks: Holyrood 1000 RPM Unit 1
RV1 49.2 ,RV2 51.0
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 1	S481/12/054A	F	8	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02
Insert condition code

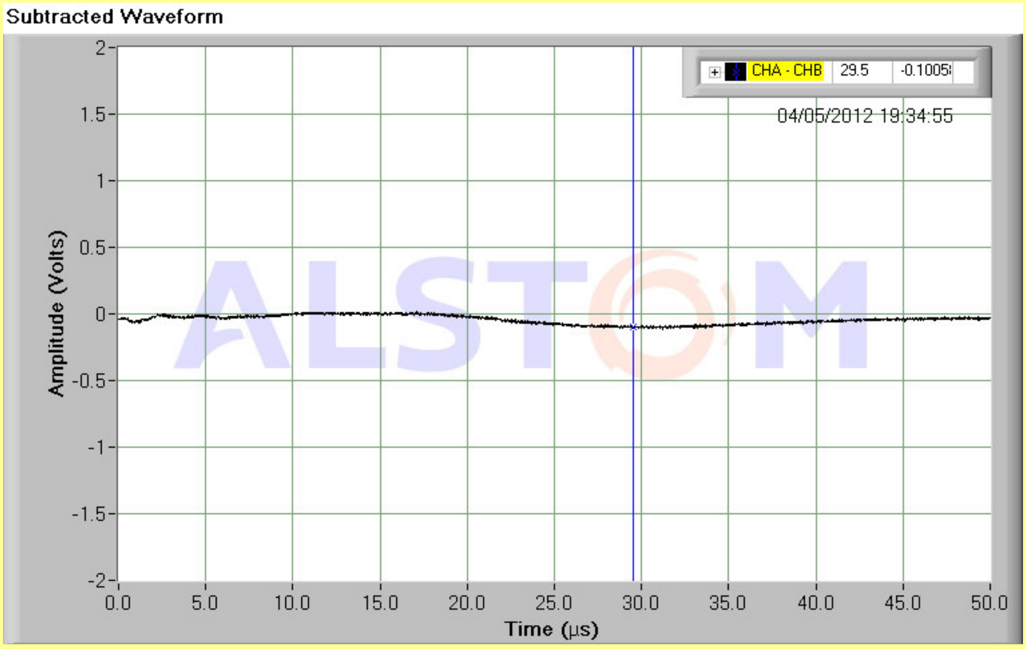
Remarks: Holyrood 500 RPM Unit 1
RV1 49.0 ,RV2 51.0
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 1	S481/12/054A	G	9	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02

Insert condition code

Remarks: Holyrood 250 RPM Unit 1
RV1 49.0 ,RV2 51.0

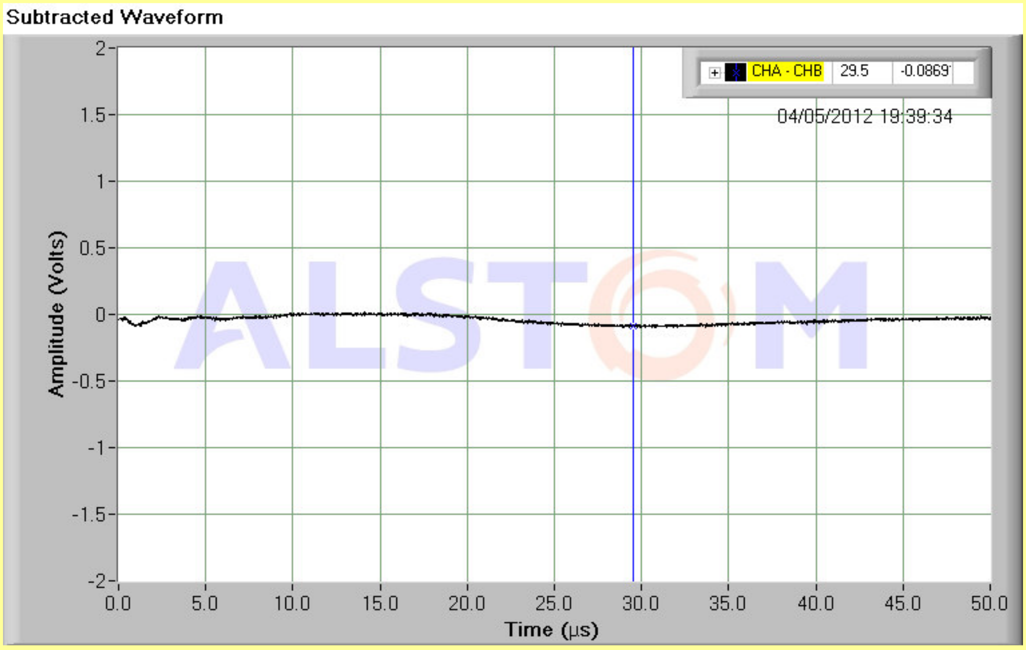
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 1	S481/12/054A	H	10	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



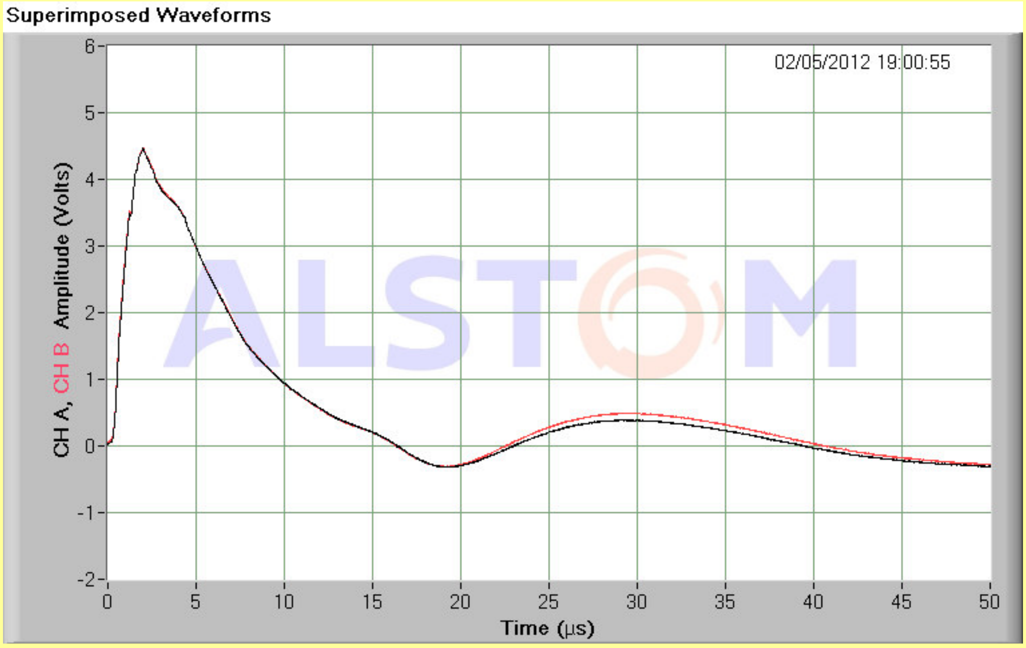
Condition during test: 02
Insert condition code

Remarks: Holyrood 100 RPM Unit 1
RV1 49.0 ,RV2 50.7
Speed during test and detailed state of disassembly

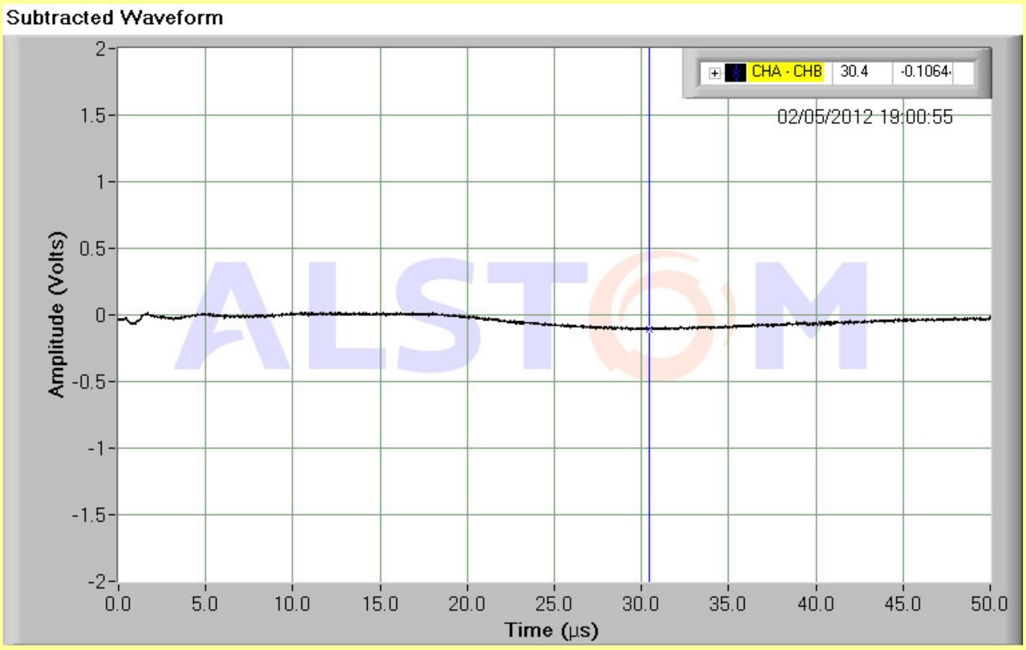
For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 1	S481/12/054A	I	11	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.



Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02
Insert condition code

Remarks: Holyrood U1, Barring 2 RPM .
RV1 49.0 ,RV2 51.0
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 1	S481/12/054A	J	12	12

Insulation Resistance Tests

After the run down of the rotor.
Insulation resistance measurements were performed on the rotor at barring speed.

See results below.

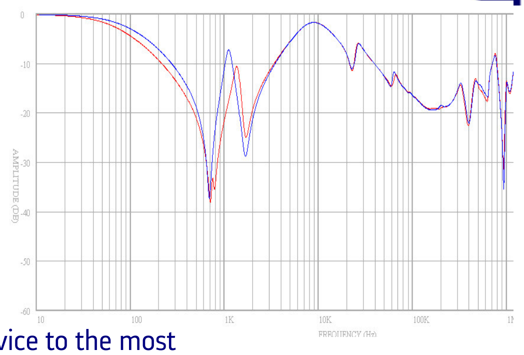
IR on rotor @ 500V DC for 1min.

Time (Sec)	IR
15	70.5 M OHM
30	271.0 M OHM
45	459.0 M OHM
60	843.0 M OHM

7. ADDITIONAL INFORMATION

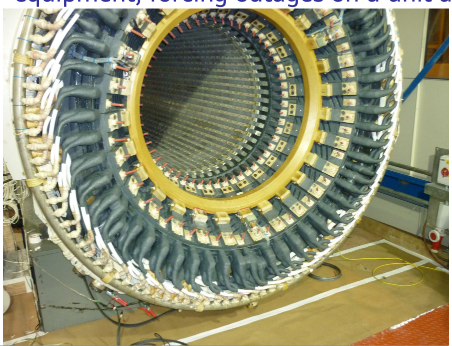
Generator Diagnostic Testing

Sweep Frequency Response Analysis



Using the latest test techniques incorporated into a highly advanced diagnostic tool. ALSTOM generator diagnostics UK can offer an **unrivalled** testing skills & response service to the most discernable client.

Power grids & station systems undergo many fault conditions either direct or indirect to their generation equipment, forcing outages on a unit and putting it out of service.



Key advantages to clients

- SFRA Fault response to provide diagnostic tests, with minimal work required on unit.
- SFRA can be provided as a stand alone test or with the following:

1. Stator & Rotor IR tests.
2. Stator & Rotor resistance measurements.
3. Sequence Impedance tests.
4. Rotor RSO & impedance tests.
5. Frequency injection, Tan Delta & dielectric loss angle measurements.
6. Harmonic analysis on units operating.

- Fleet assessments can be made building fingerprints as part of a condition based maintenance.

The ALSTOM Sweep Frequency Response Analysis tool (SFRA) is a non-destructive low voltage electrical non-intrusive measurement.
Making an assessment of the insulation system characteristics of the rotating machine.

Opportunity

The SFRA measurement can be performed on any type of machine both stator & rotor insulation systems. This test can be performed in many environmental conditions including hydrogen, air with winding coolant circulating.
The only requirement is that the machine must be removed from the bus bar system, so that the test is purely looking at the stator or rotor.
A minor outage is just required to build the initial fingerprint.

Background

The SFRA diagnostic tool performs the measurement by injecting a voltage signal over a defined frequency range.
The reference injection is monitored continually with respect to the measured output from the analyzer.
The characteristics of the complex RLC networks & response of the insulation system, associated components are recorded and graphically displayed.
Measurements are performed on each phase / winding of the unit and or rotor.
Comparison analysis takes place checking for differences in response & magnitude of the phase deviation.

Looking at the response over different frequency ranges gives an insight into the different components that make up the insulation system.

From these results ALSTOM generator diagnostics provide a detailed analysis report.

Features

The SFRA PC based measurement system
Looks at specific areas of the unit. Analysis is performed on end winding condition, phase barriers, stator slot windings, phase ends / rings, all electrical connections & terminals including earth paths & the stator core.
The features of the system are:

- Up to 6000 steps per measurement.
- Up to 10 VAC test level
- Software based analysis program
- Selected frequency range to suit unit.
- Historical Database used for comparisons.

Results can be collated to form a main report detailing all findings.

Experience

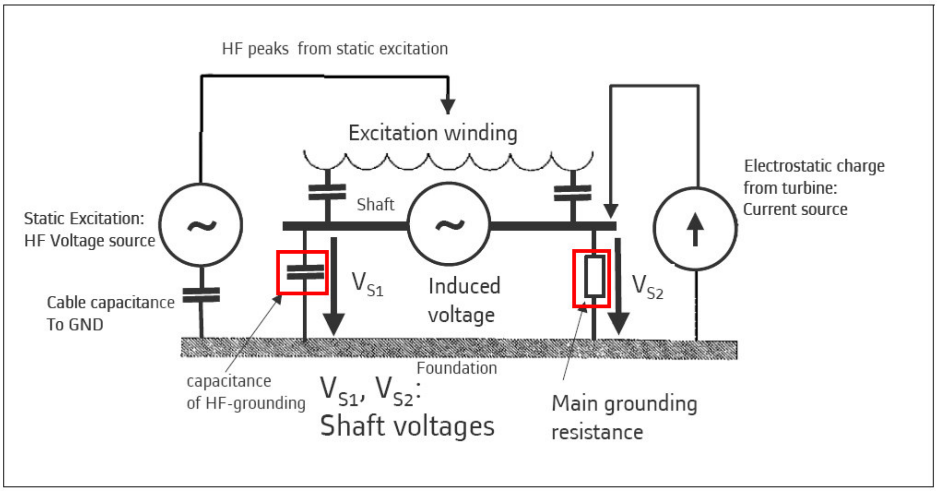
ALSTOM generator diagnostics UK has performed this test on various types of equipment in various scenarios under different fault conditions. Our team can meet your testing requirements if via a forced outage (24hr response time), or as part of a planned outage, surveying all machines in a fleet & providing recommendations on future operations of units.

For further information contact :
David-LSmith@power.alstom.com.

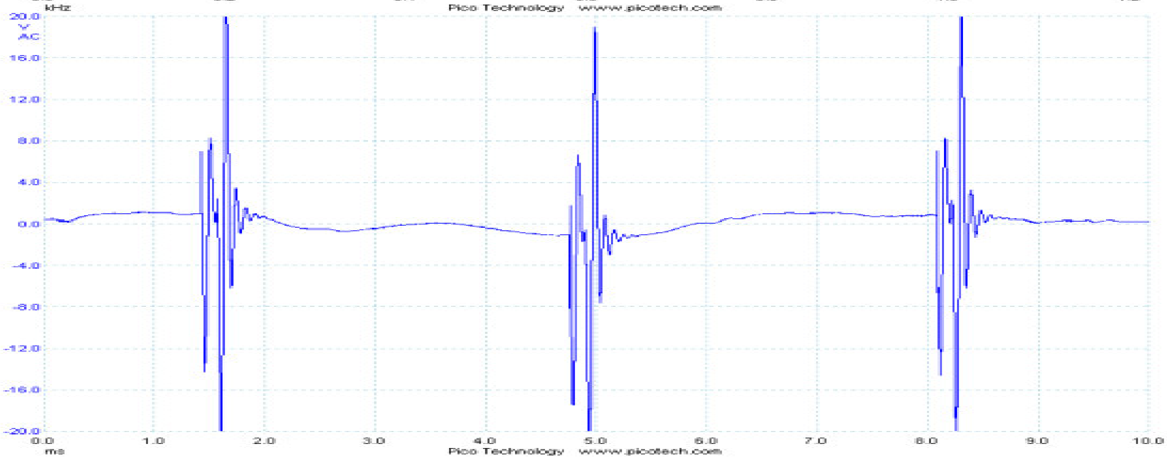
ALSTOM
UK Generator Diagnostics

SHAFT VOLTAGE MEASUREMENTS

Induced shaft voltages are a magnitude of the magnetic features / structures that make up the machine.
These voltages are characteristics of the machine and the conditions in which it operates within.
They are influenced by the load type, power levels active and reactive.
Characteristics that are measured can be said to be a magnetic fingerprint of the machine.
The ring flux that is circulating induces an emf (Electro Motive Force). The emf is present in the loop created by the shaft & generator housing, thus potential differences arise.
These rises in voltage are referenced between the shaft & ground potential.



Monitoring of the shaft voltages including harmonics can trend the characteristics.
Working to specific criteria the voltage levels can be tracked & highlight issues before problems occur.
The main issues that can occur are capacitive coupling on the bearing surface area due to rubbing resulting in electro-erosion and pitting.



Monitoring Overview

Benefits from our expertise gained

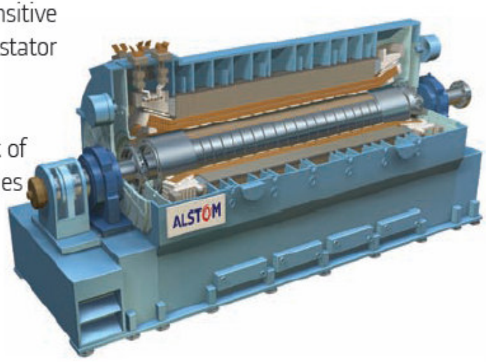
Monitoring Services

Generator operation data: link operation condition to the various monitoring modules indicating load dependent component condition.

Partial Discharge Monitoring: Partial discharge measurement using high sensitive bus couplers indicating weaknesses in stator winding insulation system.

End Winding Vibration: Measurement of end winding vibration indicating changes in stiffness of end winding support system.

Stator bar temperature monitoring TEMPO™: Individual recording of cooling water temperature for H_2O cooled machines.



Shaftline vibration monitoring: Vibration recording system for the rotor shaft.

Rotor shaft voltage ROMON®: Shaft voltage measurement indicating rotor winding and shaft grounding condition.

Rotor Insulation Monitoring: Rotor insulation monitoring for machines with brushless exciters using rotor telemetry.

Four levels of monitoring available:

- Level 4: + data connection to central server (e.g. Utility headquarter), extended remote support with Service Centre expertise and continuous data assessment
- Level 3: + permanent equipment, local server, remote access and data assessment on request
- Level 2: + portable equipment, local data collection and periodic data assessment
- Level 1: Sensor, cabling and connection box

Test results and reports: Monitoring results are evaluated remotely in our Local Service Centres / Plant Support Centres. After a detailed evaluation of the results, a report will be prepared for the clients showing a summary of the results and with proposals for medium and / or long-term courses of action.

8. APPENDICES :TEST EQUIPMENT

Handy Scope	HS3	SN: 23220	Cal Due 02/03/13
RSO Sig Gen	MK1	0604-007	Cal Due 24/05/12
Fluke IR Tester	1550B	Hydro 5896	Cal Due (Unknown)

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www.alstom.com

ALSTOM

ALSTOM	Generator Services		Document No. UTGE672107	
Prepared: J. Jensen 09/07/12	Checked: C. Smith 09/19/12	Std. Checked:	Approved: J. Fiaux 09/19/12	
Revision: A	Rev. Prepared: J. Jensen 09/26/12	Rev. Checked: A. Sowell 09/26/12	Rev. Approved: J. Fiaux 09/26/12	
Resp. Dept.: 6104	Reference:	Language: English	Page No.: 1	Total Pages: 5

Recommendations for Newfoundland & Labrador Hydro

Holyrood #1 Generator

Table of Contents **Page**

1. Purpose

This document provides recommendations for additional workscope to be included during the upcoming stator rewind of the Holyrood #1 generator. The recommendations are based on the results of the major inspection completed during the Spring 2012 outage.

2. Applicability

This document is applicable to the Holyrood #1 generator.

3. References

CFRG 015595, Generator Diagnostics

FSRG 015977, Bump Test Report

FSRG 015121, D6 Major Inspection

S481/12/054, Generator Shutdown Test Report

4. Spring 2012 Outage Inspection Findings

4.1. Generator Diagnostics (as reported in CFRG 015595)

A thorough inspection of the generator stator and rotor were performed in accordance with Alstom's WIDIPRO II inspection program which includes a complete visual inspection of the generator rotor and stator, electrical tests on the rotor and stator and an EI-CID test on the stator core. A detailed description of the tests performed and the results are reported in CFRG 015595.

The inspections and tests performed found the generator stator to be in generally good condition. The findings are summarized below:

- Minor dirt contamination
- Minor greasing on the phase rings and leads
- Small areas of corona damage on the winding at the DE and NDE
- Cracked paint at the winding slot exit area indicating minor bar movement
- Minor cracking at the insulation caps
- One stator winding RTD found to be inoperable

All findings were addressed during the outage except for the broken RTD.

The inspections and tests performed on the generator rotor found it to be in good condition with no findings reported.

4.2. Bump Test (as reported in FSRG 015977)

Bump testing was performed on the DE and NDE stator end windings and phase connections. The testing included linearity and reciprocity tests, global modal analysis and driving point measurements. A detailed description of the testing performed and the results are reported in FSRG 015977.

The bump testing found the stator winding structure to be coherent with no 4 node elliptical modes within the critical range of 115-135Hz at the DE or NDE. There were, however, some driving point measurements, taken on the series connections in the tangential direction, with responses greater than Alstom's acceptance criteria of 500nm/N.

Testing of the phase connections also found several with responses greater than Alstom's acceptance criteria of 500nm/N.

Although there was no evidence of global resonance the high responses found during some of the driving point measurements indicate some local sensitivity to 120Hz resonance. The results did not indicate a need for repairs and no additional action was taken although future monitoring was recommended.

4.3. Mechanical Inspections (as reported in FSRG 015121)

Inspections and measurements were performed on the components disturbed during the rotor removal and reinstallation process. This includes visual inspections & measurements of all H2 seals, oil wipers, oil seals, oil deflectors, bearings and corresponding shaft journals.

The findings are summarized below:

- H2 seals were found to be scored and measurements indicate they are out of tolerance and should be replaced at the next available outage.
- Inner oil deflectors at bearing #4 & #5 are out of tolerance and should be replaced at next available outage.
- Both H2 seal casing oil deflectors were found with excessive clearance and should be replaced at the next available outage.
- One of the belly bands at the back of the stator core was found to have greasing
- The collector rings were found out of round

The tightness of the belly band bolting was checked and the collector rings were ground to correct the out of round condition however the H2 seals, inner oil deflectors and H2 seal casing oil deflectors were not replaced during the outage.

4.4. Generator Shutdown Test Report (as reported in S481/12/054)

The RSO test performed at speed and during shutdown showed very minor indications of inter-turn shorts in the rotor windings which were within the Alstom acceptance criteria for this test. Another finding was the presence of electro-erosion on the shaft surface which is an indication of poor shaft grounding and a recommendation was made to replace the shaft grounding device with a direct contact braided grounding strap.

5. Recommendations

5.1. Stator

The inspections and tests performed on the stator found relatively minor issues which are generally confined to what would normally be expected for a unit of this age. These issues would normally be addressed during a stator rewind. Therefore the recommended additional work scope is limited to those components which are not normally repaired or replaced during a stator rewind.

In general there is no evidence that major repair work or replacement of the end winding support system, phase rings, core, etc. is necessary to ensure the unit is suitable for long term operation following the rewind. The additional workscope is limited to the following:

- Replace broken instrumentation
- Inspect belly bands at the back of the core for greasing
- Check belly band bolt torque and retighten as required
- Perform core loop test
- Replace DE and NDE H2 seals
- Replace DE and NDE inner oil deflectors
- Replace shaft grounding device with a direct contact braided grounding strap

5.2. Rotor

The inspections and tests performed on the rotor also found minor issues which are not indicative of a near term requirement for a rotor rewind. However, given the age of the rotor the following workscope is recommended to be performed during the upcoming stator rewind:

- Complete visual inspection
- Initial electrical tests (megger, PI, pole balance)
- Remove retaining rings
- Visual inspection of end windings
- PT inspection of retaining rings
- Electrical tests after removal of retaining rings (three step voltage test, pole balance, RSO)
- Re-install retaining rings with new insulation
- Electrical tests after installation of each retaining ring (megger, pole balance)
- Final electrical test (RSO)

6. <u>Conclusion</u>

6.1. The Spring 2012 outage found that the generator is in generally good condition. The inspections and tests performed on the generator found some minor issues. These issues can be addressed during the upcoming stator rewind and do not indicate a need for any major additional repair work on stator or rotor components beyond the normal scope of a stator rewind. The inspection findings indicate there are no immediate concerns with the rotor. However, given the age of the unit, the opportunity should be taken to perform an inspection with the retaining rings removed during the upcoming stator rewind.

Customer Field Service Report

Task	**Generator DIRIS Inspection**
Unit	HOLYROOD 2
System	Generator
Date	28.11.2012
Report No.	**CFRG016650**
Author	Ken ROBERTS
Reviewed by	Ghanshyam Patel
Approved by	John A Jensen

CFSR received by Customer

Name	Department	Date	Signature

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TABLE OF CONTENT

1. Summary

The Generator top halfs were removed to accomodate a DIRIS inspection. Internal measurements were taken for future Stator rewind work. During the dismantle it was noticed the control valves were left in the open position. The brought up a safety concern for stored energy and it was taken care of. During this outage 5 NRV,s were dismantled and repaired as per attached report and data sheets.

2. Purpose and duration of assignment

Purpose of assignment	Arrival Date	Departure Date
Unit 2 Generator inspection and NRV repairs	17.09.2012	02.10.2012

3. Milestones

Unit	HOLYROOD 2		
No.	Milestone	Planned Date	Actual Date
1	None Identified		

4. Personnel involved

Unit		HOLYROOD 2					
No.	Name	Department	Code	Function	Position	Arrival Date	Departure Date
1	John Adams		SIM	Site Management Site Manager	Manager		
2	Aldin McLaughlin						
3	Ken Roberts	Power Thermal Services	TFA	Technical Field Advisor	Lead		
4	Sherry Moore Hickey						
5	George Lannon						
6	Klaus (Mo) Morrwek			Diagnostic Engineer	Engineer		
7	Domonik Loosli			Mechatronics	Engineer		

5. Operation data

Nothing to report

6. Technical information

Unit		HOLYROOD 2		
Type of data		Technical Information Generator		
No.	Description	Unit	Reading / Value	Remarks
1	Type	-	ATB 2 Poles 60 Cycles	
2	Generator / Stator Serial No.	-	980486	
3	Manufacturer (OEM) / Supplier	-	GE	
4	Rotor Serial No.	-	-	
5	Rated Speed	rpm	3600	
6	Rated Frequency	Hz	60	
7	Rated Apparent Power	kVA		
8	Rated Power Factor	-	0.90	
9	Rated Stator Voltage	kV	16.00	
10	Rated Stator Current	A	7016	
11	Rated Field Voltage	kV_{DC}	0.375	
12	Rated Field Current	A_{DC}	1864	
13	Insulation system	(stator wind.)		
14	Insulation class	(stator wind.)	F	
15	Cooling System (medium)	(rotor/stator)	H2	
16	Excitation System	-		
17	Exciter Type	-		
18	Exciter Fabrication No.	-		

7. Work carried out

7.1. Dismantle of Generator

The outer oil deflector clearances were taken for reference.
The HP top N1 gland was removed to accommodate the removal of the front standard cover.
The front standard cover was removed to accommodate turning of the turning gear by hand.
The Turning gear pinion was found loose and could have come adrift.(Photo to Right)

The control valves were found isolated and oil off , but the control valves were open and under spring tension.
This posed a safety hazard and a clam shell was installed so the main hydraulic actuator did not move.
After this was reported to site, site asked that we close the valves prior to our completion.
The clam shell was removed and the large hook was lowered to apply weight to close the hydraulic actuator.(no Issues)

The slip rings were found with a heavy oxidized surface.

The generator man hole doors were opened and the inner end shield bolts were removed from both ends.
The bearing covers,keeps and top half bearings were removed.
It was noted on the NDE that there were no vertical dowels in place.
The top half H2 seals were removed and the inner oil deflector clearances were taken.
The NDE upper inner baffle stand off fibber bolts were broken on disassembly. Site had 3 new ones.

The inner oil deflectors and top half end shields were removed.
The intent of this inspection was not to remove the lower half components to reduce time and cost of the inspection.
The fan ring clearance was taken at both ends. The top half inner end shields were removed.
The top half of the fan blades were removed.

The centre gas baffle was removed on the TE
The GE end lower inner end shield had to be rotated out to accommodate the gas baffle removal.

At the start of the DIRIS inspection, it was found that the slip ring end of the generator was grounded.
The bearing and H2 seal were insulated,and the inner and outer oil deflectors were grounded.
The outer oil deflector was cleaned and cleared. The inner was also cleared but,at 80 volts it went to ground.
The ground at the insulated end had to be cleared or the DIRIS inspection cannot be completed.
The outer oil deflector was removed and the rotor jack was installed. The rotor was raised and the ground cleared.
The stator core measurements were completed.
The generator components were being cleaned during the DIRIS testing.
Due to the lack of clearance on the NDE inner oil deflector, the bearing & lower H2 seal had to be removed to set the inner oil deflector. It was also noted the inner oil deflector bolts had insulated washers but not insulated bolts.
The NDE outer oil deflector had a gasket and no insulated washers.

During the bearing and keep removal there were several circular marks on the journal and heavy frosting in the bearing from arcing.
The circular arcing may have come from welding in the past.

The lower bearing NDE had two crack indications,one straight and one half circle. NDT cleared both indications in 3rd photo below.

There was heavy shaft and bearing scoring due to oil contamination. The Journal was strapped and the bearing was cleaned up.
When the lower bearing keeps were removed, it was also noted that there was severe arcing on the lower end bell.
The NDE journal where the grounding brushes operate was found to be very rusty(long term)
The H2 coolers were visible from the end cover being removed. They had a heavy yellow varnish build-up.

7.2. Testing of the Stator

A DIRIS low flux test was completed by Klaus Morawek and Dominik Loosli. The DIRIS test required the insulated end to be clear to complete this test.
This testing took aprox 2,10 shifts. The robot was also tested to do wedge tap testing and this was successful.
For the testing see Klaus and Doninik's report.

7.3. Inspection & Repair & Findings

During the Generator DIRIS inspection there were several findings.
The NDE rotor had many scores from partial contamination and electrical arcing
There was severe arcing found on the lower end bell RH side between the insulated keeper ring and casing.
The journal where the ground brush runs has a heavy rust surface. It was strapped clean. There was still heavy pitting on the turbine journal.
The bearings had partial contamination embedded in the Babbitt. The bearings were scrapped and polished up.
Both DE & NDE outboard surfaces were rusty.Also there seemed to be light rusting on the generator rotor.
This is caused from oil systems being shut down and the generator being degassed.
The H2 seal had a damaged corner on one segment that would not allow the segment to seat properly.This was not new due to this segment had no radial grooving from oil contamination and running on the journal.
The damaged corner was cleaned up and the seal seated properly.
This could have caused excess seal oil loss & possibly hydrogen leakage.
The H2 seal on the NDE was missing its vertical support dowels. New dowels were fabricated from the broken

Inner end shield fibreglass stand off bolts
The inner oil deflector was found with no lower clearance and was grounded. This was, and had to be adjusted to clear the ground and provide running clearance.
To operate this unit manually on turning gear, oil has to be off and the front standard cover removed. In order to remove
the front standard insulation has to be removed from the HP steam gland and the HP TE steam gland has to be removed.

7.4. Reassembly of the Generator

The generator H2 seal on the NDE was found with a damaged corner that would not let the outer left side seal at the horizontal joint.
This was confirmed by the scoring, from dirt in the oil on all journal to seal faces with the exception of the damaged one . It was found with a new machined finish aprox 95% of its contacting surface.
The inner gas baffles were reinstalled with the existing nylock stainless nuts with blue locktite. (due to no new ones in stock)
The lower inner end shield was rolled in, dowelled, bolted and lock tabbed.
The top half fan blades were installed torqued and tabbed both ends.
The rotor was rotated and the remainder of the fan blades were installed,torqued to 275 ft lbs& lock tabbed.
The top half fan ring and inner end shields were installed.
The as left fan blade to fan ring clearances were taken.
TFA confirmed all bolting secure and tabbed.
The lower areas between the inner and outer end shield were vacuumed.
Medium weight Tite- Seal was applied to the ends of the generator and the end shields were installed.
The rotor weight was taken from the lower endshield and the top halves were torqued with the H2 seal surfaces within .002"
The 2" bolts were torqued to 2600 ft lbs and the 1 1/2" bolts were torqued to 1400 ft lbs and the 1 1/4" were torqued to 750 ft lbs.
The horizontals were completed first and then the face bolts.
The rotor wt was placed back in the bearings once the endshields were aligned and bolted
DE.
The DE lower inner oil deflector clearance was taken. The lower deflector ,H2 seal and bearing were never removed.
The lower oil deflector oil deflector clearance was taken.
No lower twist and tilt were taken due to the bearing not being disturbed.
The inner oil deflector was installed with tite seal and clearances taken.
The top half H2 seal was installed with titeseal on the face and blue RTV on the horizontal joint.
A dead blow was used to insure the H2 seals were not hung up.The gaps looked good at the journal the gaps at the ends of the seal were tight.
The seal was not dismantled, due to the requirement of needing both halfs.
The bolts were tie wired and confirmed by TFA
The top half bearing nip check was completed. A minor shim adjustment had to be made for corrections for a .000 crush.
The bearing keep was installed .
The lower end bell and return oil lines were scoped for foreign material. (nothing was found)
The outer oil deflector was set and boxed up.
The fire deluge lines and hand rails were installed.
Site were informed to install instrumentation and ground brushes.
NDE
The lower inner oil deflector was installed with titeseal. The bearing was installed to set the inner oil deflector clearance
The lower oil deflector was set and the top half installed. Clearance checks were completed.
The journal was raised .015" and the bearing & Keeps were removed.
The H2 seal was installed with a small amount of titeseal on the face and Blue rtv on the horizontal joint.
The seal had 2 new fibreglass dowels installed and megger check completed, megger was clear, with bolts tight and lock wired.
The lower half bearing was installed and site installed the TE's. Twist & tilt completed-horns were parallel and bearing level matched the journal.
The bearing had a lead check and was .022" vertical clearance.The bearing had a Megger & insulation was good.
A bearing dowel was dropped and the return oil line was removed and reinstalled
The lower end shield and oil return line was boroscoped and found clear.

The top half bearing was installed and nip check completed.
The top bearing cover was titesealed and installed.
The outer oil deflector was installed with a new gasket and the clearance was a little tight on the top and left side.
The DE & NDE was pumped from both sides with light weight titeseal with the top plug removed.The man hole covers were reinstalled with new gaskets and a little blue RTV.
The top plugs were reinstalled.
The brush gear housing was bolted to the end bell. TFA was not present for the final oil deflector adjustment on NDE.Witnessed by J Adams
The slip rings were polished with 240 grit emery paper to remove the rust build up.
The deluge line was reinstalled.

The Front standard turning gear pinion was aligned and tightened.
The Hp N1 packing gland was reinstalled and the front standard was also reinstalled with titeseal applied.
Site was to connect a electrical connections, brush gear & vibration probes.

7.5. Recommendations

1. Turbine turning gear motor modification could accommodate turbine rotor rotation for maintenance and in the event of drive motor failure or electrical supply failure. If the motor had a through shaft a drive coupling could be installed to turn the turbine turning gear motor manually or with a portable air drive that could be set-up in a couple of minutes. This would require a small access cover installed in the front panel. This would eliminate the dismantle of the front standard and HP gland for manual turning gear access.

2. A review of shutdown process to prevent turbine/generator oxidation. If the lube oil & Seal system are in service the generator can be left on co2 to prevent moisture issues and oxidation. The ground strap journal area
and collector ring area would no rust if the machine is left on turning gear.

3.Due to the oil contamination, journal scores. H2 seal scoring and contaminants embedded in the bearing Babbitt,
   - Oil system review
   - Oil flush should be preformed, monthly oil samples?
   - Site have found large amount of sludge the oil tank.
   - Is the oil tank stagnating / biological growth during long periods of out of service: Recommend oil systems remain in service when possible.

4. Recommend Generator bearing re-babbitting during next outage.
   - Due to partial contaminants embedded in the existing babbitt

5. Recommend that site have a generator seal mandrel fabricated for generator H2 seal inspection.

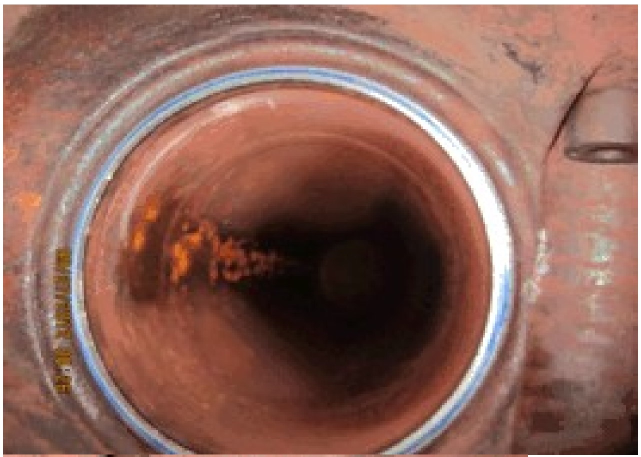
6. Generator ground strap modification
   - replace existing ground brush with braided strap
   - A PM created to polish turbine journal if unit is out of service for long periods
   - A electronic module for removing electrical spikes at the insulated NDE
7. During the next outage , It is recommended that the Hs coolers be cleaned and Talking to site the coolers have never been Eddie current tested. The recommendation is to do an Eddie current test to check wall thickness of cooler tubes.

7.6. Non-Return Valve Repairs

During the generator inspection five NRV's were dismantled to install new components ordered due to an earlier inspection this year. The valve's all had new gaskets,shaft packing. All seats were lapped using the new swing arms and lubricated discs with stick back emery. It was driven by a 1/2" air ratchet. The disc to arm clearance was .100"-.120" to allow full seat contact between seat and disc. Photos were taken for disc to seat blue contact. Some of these valves had older weld repairs that may have caused distortion.On the next planned outage a valve contractor should be brought in with a seat lapping tool. The cylinders were not overhauled at this time All the seats had good contact. The Blue contacts for the valves may have required more than one shot due to the flash reflection.

NRV101 Sept 20th

9/27/2012 NRV 104B



9/26/2012 NRV 104A

10/2/2012 NRV 102

9/28/2012 NRV103

8. Open Items

Nothing to report

9. Spare parts

Nothing to report

10. Software backup and data

Nothing to report.

11. Appendix

No item included

12. Enclosure

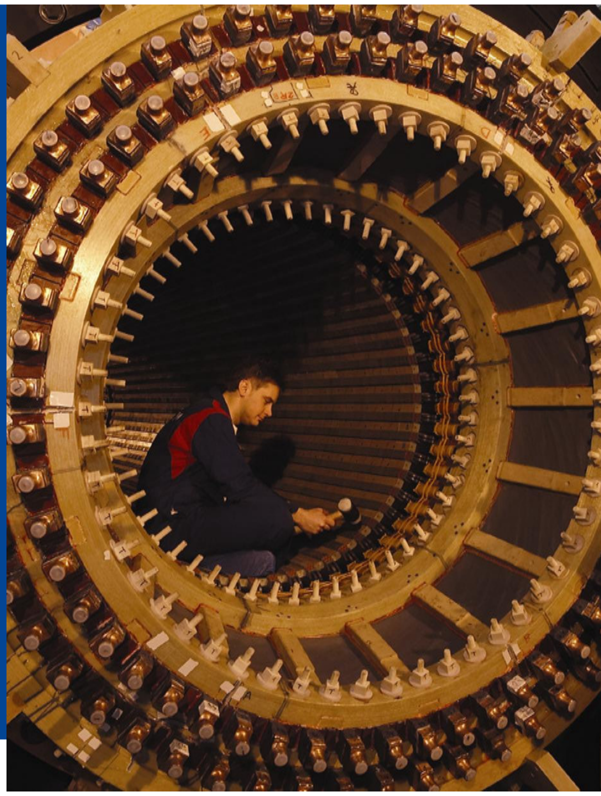
No enclosures

Generator Diagnostics

GENERATOR SHUTDOWN TEST REPORT

HOLYROOD UNIT 2 MAY 2012

S481/12/053



POWER
THERMAL SERVICES
United Kingdom

ALSTOM

newfoundland labrador hydro
a nalcor energy company

HOLYROOD POWER PLANT

ALSTOM PROJECT NO. 9PS01599

Written By:

David Smith
Engineer, Generator Diagnostics

Approved By:

William Kimberlee
Senior Test Engineer, Generator Condition Monitoring

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Mr. P. Ingram	(ALSTOM UK – Project Manager)
Mr.A.Lumley	(ALSTOM UK – Manager Condition Monitoring)
Central File	

1. ASSESSMENT SUMMARY

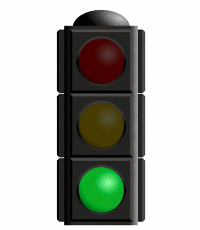
This report details the measurements carried out on the 1st of May 2012 at Holyrood Power Plant by Mr David Smith of Alstom Power Generator Diagnostics UK.

Unit 2

These shut down tests are part of a planned outage.
The outage is due to start approximately two weeks after this test date, with a minor inspection planned.

After an unplanned trip of the turbine being put down to the excitation system being in auto, the unit was run up again in manual.
RSO (Repetitive Surge Oscillograph) measurements were taken from FSNL (Full Speed No Load 3600RPM) to barring speed, checking the performance characteristic of the rotor windings as the centrifugal forces reduced.
The client reported no increase in vibration levels or increased excitation required to achieve rated output from the rotor. No temperature issues to report.
The insulation resistance test performed on the rotor showed no issues present with respect to the rotor windings & the rotor body (earth)

The only issue reported by the client on this machine was a sparking shaft earth brush.



The RSO measurements taken at 3600 RPM no load and down to barring, show no indications of any inter turn faults being present.

2. CONCLUSIONS AND RECOMMENDATIONS

Examination of the shaft showed the activity of electro erosion present. This can be put down to a poor contact surface or a poor earth path.
It was noted that there isn't a direct earth path, this system entrusts the bolted circuit that the earth brackets are held on with instead of a direct wire method.
Installation of the braid shaft earthing should be made on the next outage.
Perform shaft voltage measurements at regular intervals and load points.
Included in the additional information section is a new diagnostic test (SFRA) Alstom UK now offers, this we recommend to be included every three years on minor inspections only access required is to the output terminals.
Also included is a small over view on monitoring options available for the generator also information on shaft voltages & the background.

Keep performing inspections as per exsisting schedules & any problems encountered contact Alstom for any support required.

3. REFERENCES

Due to the maintenance & outage work being recently handed over to Alstom (including the turbines), there are no previous records for work undertaken or a machine history database; these tests & future work will form a foundation for the machine history records, thus creating traceable records.

4. IDENTIFICATION OF THE GENERATOR

CUSTOMER	Newfoundland and Labrador Hydro	
PLANT	Holyrood	
UNIT ID	2	
GENERATOR MANUFACTURER	CANADIAN GENERAL ELECTRIC	(1969)
GENERATOR TYPE	N/A	
ROTOR FIELD VOLTAGE	375 V	
ROTOR FIELD CURRENT	1864 A	
STATOR SERIAL NUMBER	980486	
STATOR VOLTAGE	16.0 KV	
STATOR CURRENT	7016 A	
STATOR INSULATION CLASS	N/A	
RATED OUTPUT	194,445 KVA	
FREQUENCY	60 HZ	
CONNECTION	STAR	
SPEED	3600 RPM	
COOLING SYSTEM	HYDROGEN	
POWER FACTOR	0.90	
OPERATING HOURS	168748.0	(1969- PRESENT)
NO OF STARTS	272	(1990 – PRESENT)
NO OF TRIPS	164	(1990 – PRESENT)

5. DISCUSSIONS

RSO

RSO (Re-current Surge Oscillograph) tests were carried out on the rotor winding with the shaft at rated speed. Following the trip of the unit, measurements were repeated during rundown to barring speed.

The test consists of injecting pulses simultaneously into both ends of the rotor winding via the slip rings. The two injected signals are displayed as an oscillograph. Any differences in the two traces represent a mismatched rotor winding surge impedance, indicating a discontinuity in the rotor winding.

The signal waveforms are analysed and displayed using an ADC unit and laptop computer.

The station employed the recommended 45° two brush per slip ring system.
Insulated brushes were made up for this particular test & will be kept for future RSO tests at speed.

6. TEST RESULTS

RSO

Condition during test: 01
Insert condition code

Remarks: Holyrood U2 3600 RPM FSNL
Speed during test and detailed state of disassembly

Condition Codes:

01 = Generator at nominal speed, 02 = Generator at other speeds (see remarks), 03 = Generator at standstill but housing is closed, 04 = Generator at standstill and housing is opened, 05 = Rotor is removed but still complete, 06 = Rotor is partially or complete disassembled (details see Remarks)

Remarks: As per above diagram.
Special slip ring arrangements and connections on disassembled rotor

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs
Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs
Picture 3	RSO results, Channel 1 and Channel 2, traces separated, time base 5µs
Picture 4	RSO results, Channel 1 and Channel 2, pulse propagation time 10µs

Interturn short circuit is present: N   Yes = Y; No = N

Remarks: Actual drawings of rotor windings not presently available
Insert shorted coils if known or other comments regarding the taken decision

Vibration behaviour: 1   1 = normal; 2= suspicious; 3 = > alarm level; 4 = > trip level

Remarks: Vibration levels not considered to be excessive, no excessive excitation current levels
Insert vibration levels, dependencey on excitation current or reference to other measurements

Equipment used: Oscilloscope: Handyscope/ 23221 / cal due 02/03/2013
Type/number/valid until

Pulse generator: Stafford Sig Gen / 0604-007 / Cal Due 24/05/2012
Type/number/valid until

Matching resistance: RV1 50.0 , RV2 50.4
Setting (Ohm)

Performed by: David, Smith
First name, surname

Date / time: 2012/05/01
YYYY-MM-DD-hh:mm

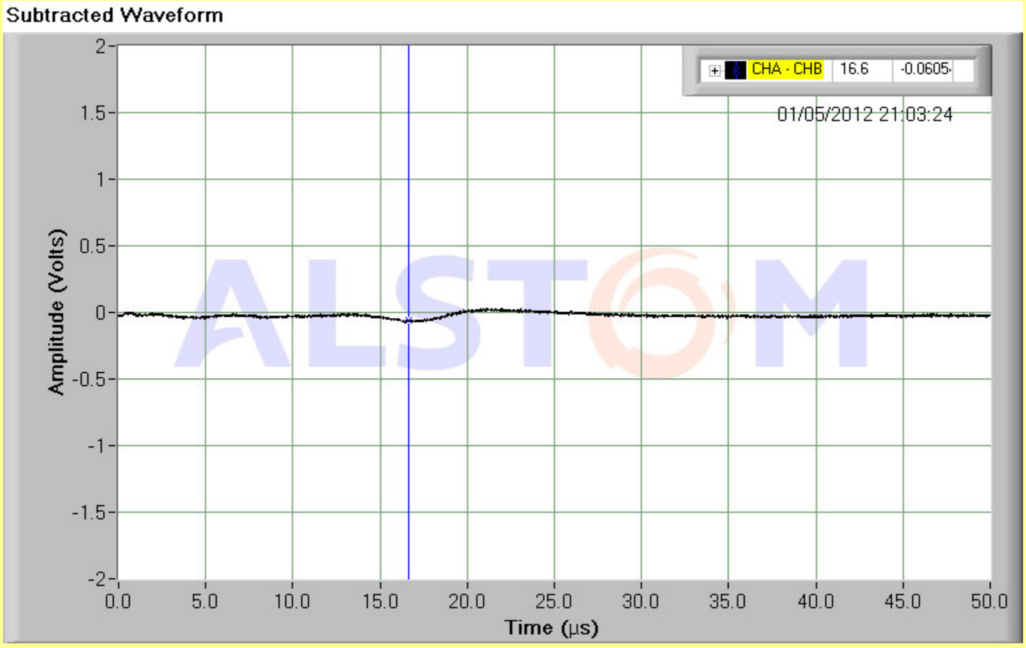
Decision: [X] Pass   [ ] To be confirmed   [ ] Failed

Remarks: Client reports sparking on shaft earth system (carbon brush type)

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 2	S481/12/053A	A1	1	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 01

Insert condition code

Remarks: Holyrood U2 3600 RPM

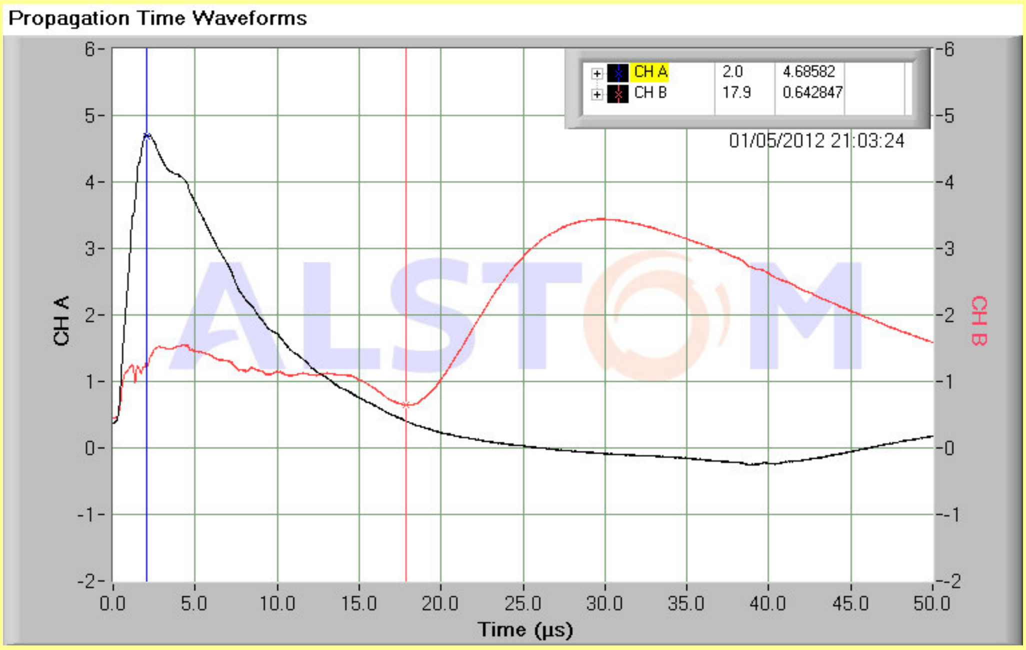
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 2	S481/12/053A	A2	2	12

Picture 3	RSO results, Channel 1 and Channel 2, traces separated, time base 5μs.

Picture 4	RSO results, Channel 1 and Channel 2, pulse propagation time, time base 10μs



Condition during test: 01
Insert condition code

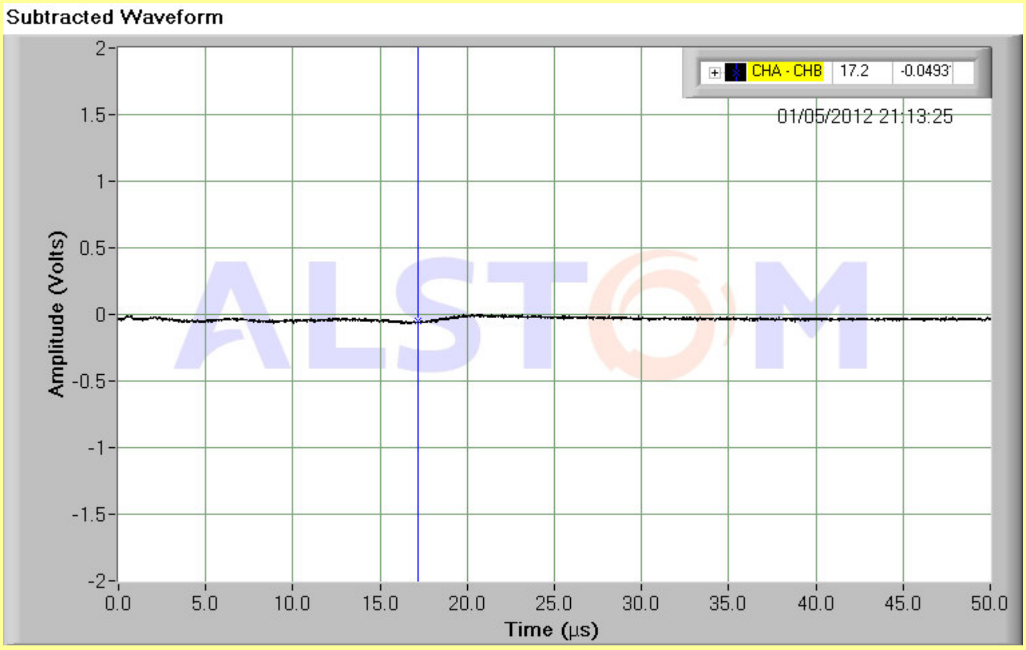
Remarks: Holyrood U2 3600 RPM
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 2	S481/12/053A	A3	3	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02
Insert condition code

Remarks: Holyrood U2 2700 RPM
RV1 50.0 , RV2 50.4

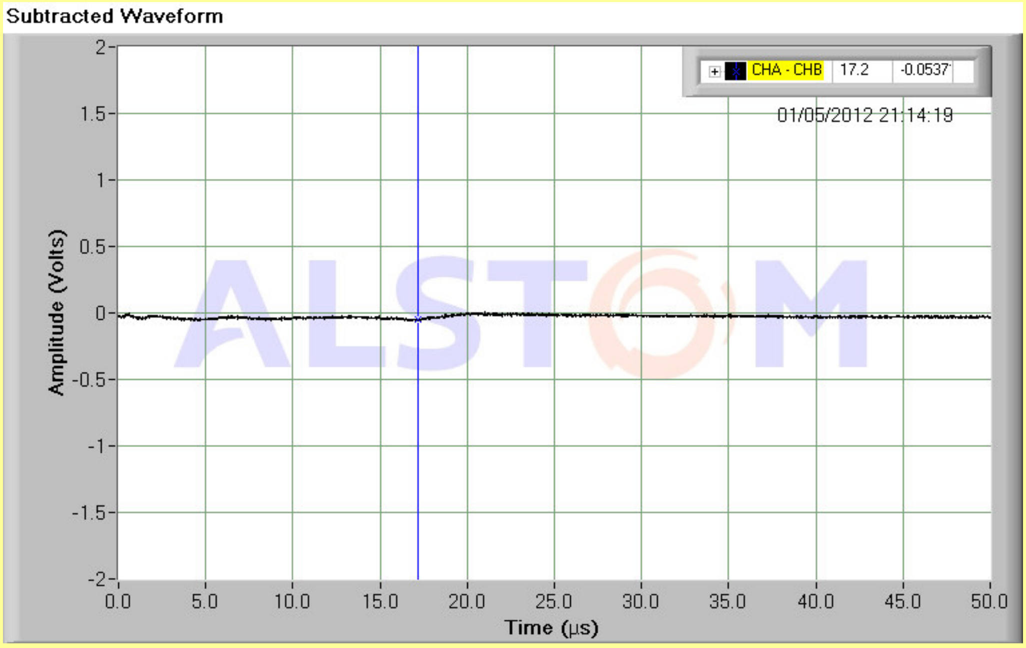
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 2	S481/12/053A	B	4	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02
Insert condition code

Remarks: Holyrood U2 2500 RPM
RV1 50.0 , RV2 50.2
Speed during test and detailed state of disassembly

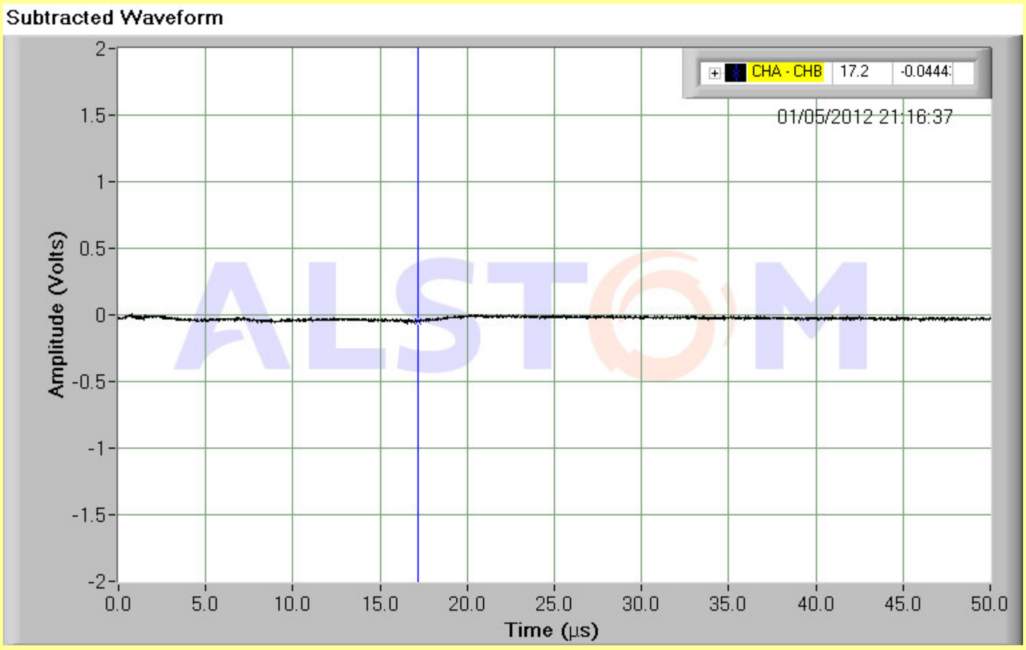
For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 2	S481/12/053A	C	5	12

ALSTOM

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02

Insert condition code

Remarks: Holyrood U2 2000 RPM
RV1 50.0 , RV2 50.2

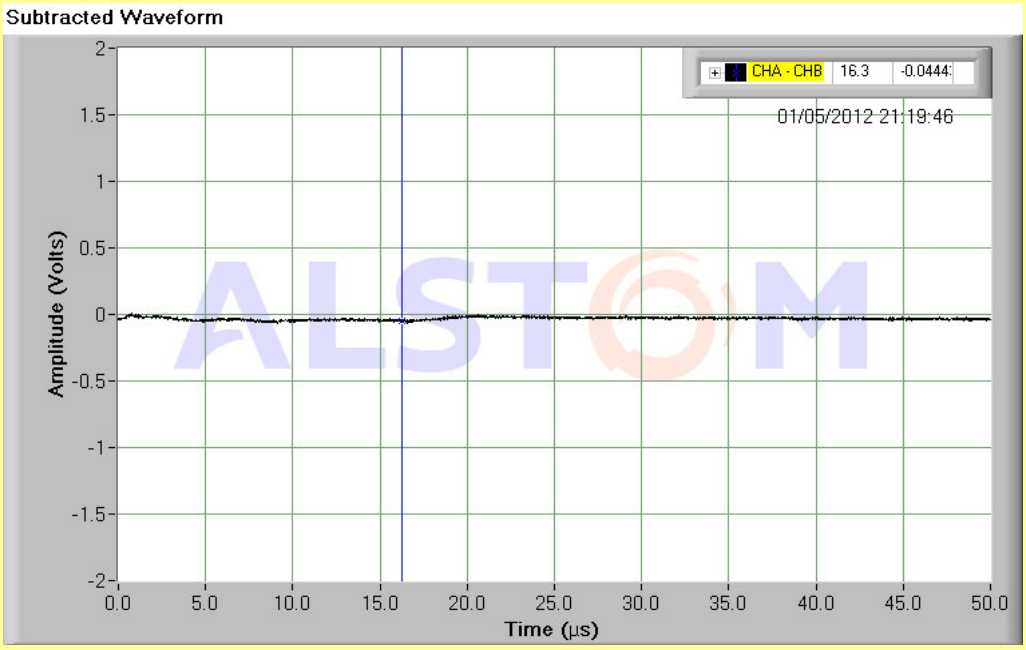
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 2	S481/12/053A	D	6	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02
Insert condition code

Remarks:
Holyrood U2 1500 RPM
RV1 50.0 , RV2 50.2
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 2	S481/12/053A	E	7	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.

Condition during test: 02
Insert condition code

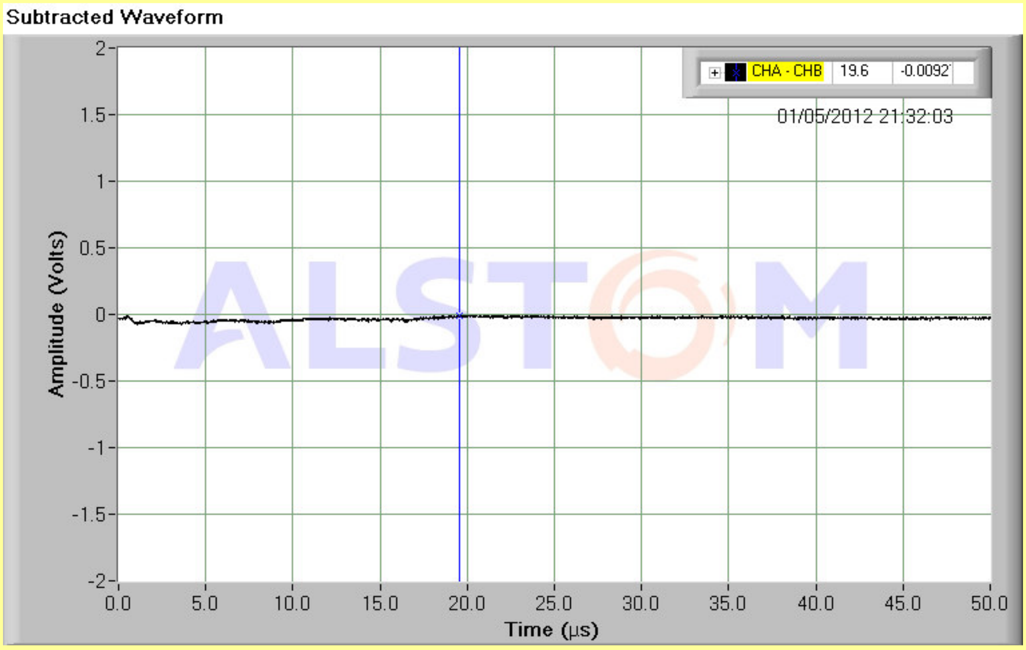
Remarks: Holyrood U2 1000 RPM
RV1 50.0 , RV2 50.2
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 2	S481/12/053A	F	8	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02
Insert condition code

Remarks: Holyrood U2 500 RPM
RV1 50.0 , RV2 50.2
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 2	S481/12/053A	G	9	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.

Condition during test: 02
Insert condition code

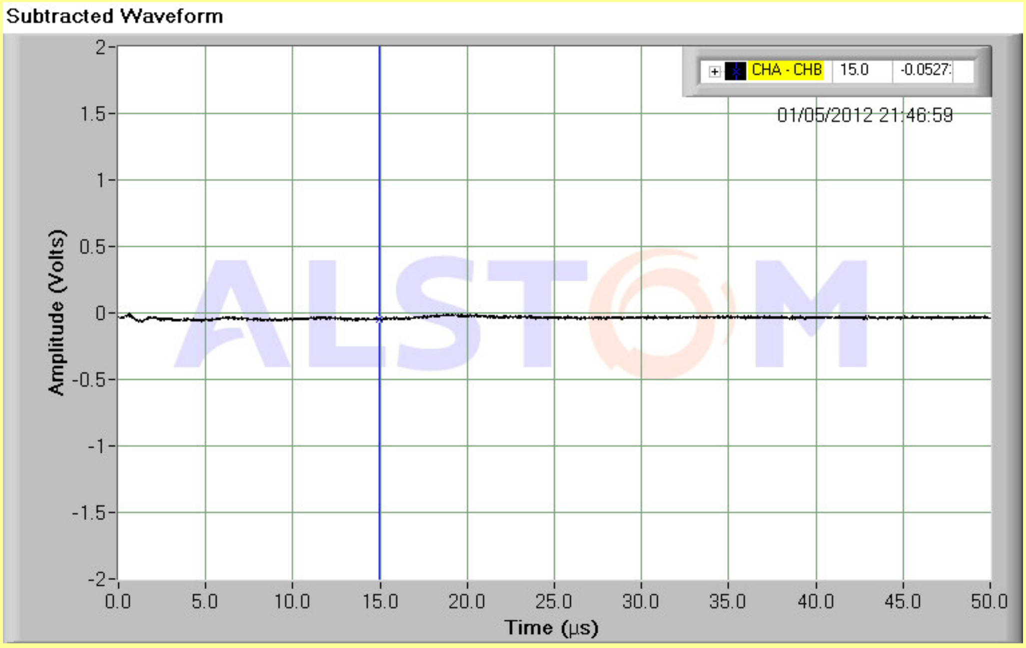
Remarks:
Holyrood U2 250 RPM
RV1 50.0 , RV2 50.8
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 2	S481/12/053A	H	10	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02
Insert condition code

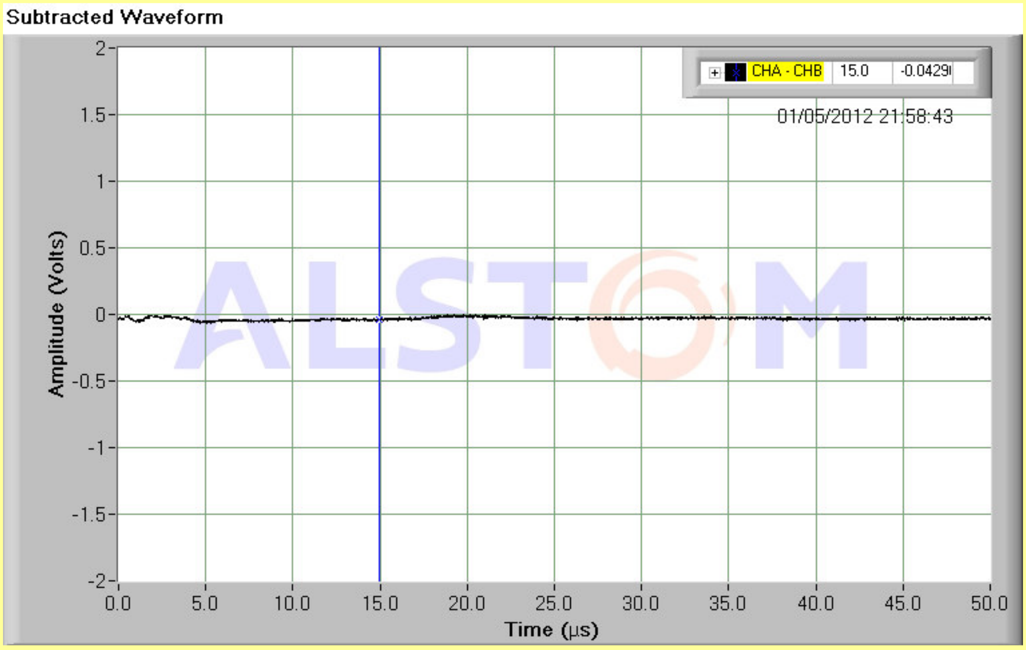
Remarks:
Holyrood U2 100 RPM
RV1 50.0 , RV2 50.8
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 2	S481/12/053A	I	11	12

Picture 1	RSO results, Channel 1 and Channel 2, traces superimposed, time base 5µs.

Picture 2	RSO results, Channel 1 and Channel 2, traces subtracted, time base 5µs.



Condition during test: 02
Insert condition code

Remarks: Holyrood U2 Barring 3 RPM
RV1 50.0 , RV2 50.8
Speed during test and detailed state of disassembly

For condition codes see user instructions.

Site / plant / unit	Report	Enclosure	Sheet	Of
Nalco Hydro / Holyrood / Unit 2	S481/12/053A	J	12	12

Insulation Resistance Tests

After the run down of the rotor.
Insulation resistance measurements were performed on the rotor at barring speed.

See results below.

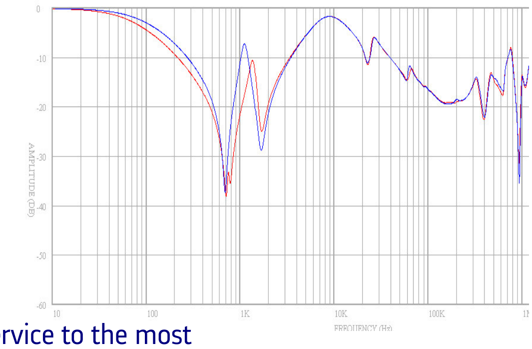
IR on rotor @ 500V DC for 1min.

Time (Sec)	IR
15	27.7 M OHM
30	202 M OHM
45	343 M OHM
60	879 M OHM

7. ADDITIONAL INFORMATION

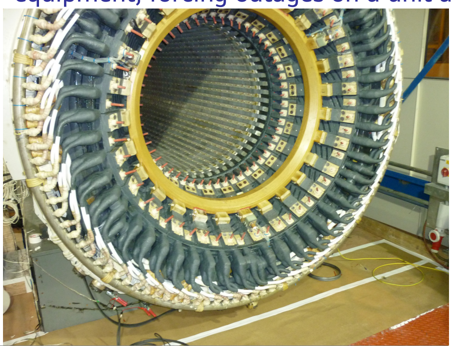
Generator Diagnostic Testing

Sweep Frequency Response Analysis



Using the latest test techniques incorporated into a highly advanced diagnostic tool. ALSTOM generator diagnostics UK can offer an **unrivalled** testing skills & response service to the most discernable client.

Power grids & station systems undergo many fault conditions either direct or indirect to their generation equipment, forcing outages on a unit and putting it out of service.



Key advantages to clients

- SFRA Fault response to provide diagnostic tests, with minimal work required on unit.
- SFRA can be provided as a stand alone test or with the following:

1. Stator & Rotor IR tests.
2. Stator & Rotor resistance measurements.
3. Sequence Impedance tests.
4. Rotor RSO & impedance tests.
5. Frequency injection, Tan Delta & dielectric loss angle measurements.
6. Harmonic analysis on units operating.

- Fleet assessments can be made building fingerprints as part of a condition based maintenance.

The ALSTOM Sweep Frequency Response Analysis tool (SFRA) is a non-destructive low voltage electrical non-intrusive measurement.
Making an assessment of the insulation system characteristics of the rotating machine.

Opportunity

The SFRA measurement can be performed on any type of machine both stator & rotor insulation systems. This test can be performed in many environmental conditions including hydrogen, air with winding coolant circulating.
The only requirement is that the machine must be removed from the bus bar system, so that the test is purely looking at the stator or rotor.
A minor outage is just required to build the initial fingerprint.

Background

The SFRA diagnostic tool performs the measurement by injecting a voltage signal over a defined frequency range.
The reference injection is monitored continually with respect to the measured output from the analyzer.
The characteristics of the complex RLC networks & response of the insulation system, associated components are recorded and graphically displayed.
Measurements are performed on each phase / winding of the unit and or rotor.
Comparison analysis takes place checking for differences in response & magnitude of the phase deviation.

Looking at the response over different frequency ranges gives an insight into the different components that make up the insulation system.

From these results ALSTOM generator diagnostics provide a detailed analysis report.

Features

The SFRA PC based measurement system
Looks at specific areas of the unit. Analysis is performed on end winding condition, phase barriers, stator slot windings, phase ends / rings, all electrical connections & terminals including earth paths & the stator core.
The features of the system are:

- Up to 6000 steps per measurement.
- Up to 10 VAC test level
- Software based analysis program
- Selected frequency range to suit unit.
- Historical Database used for comparisons.

Results can be collated to form a main report detailing all findings.

Experience

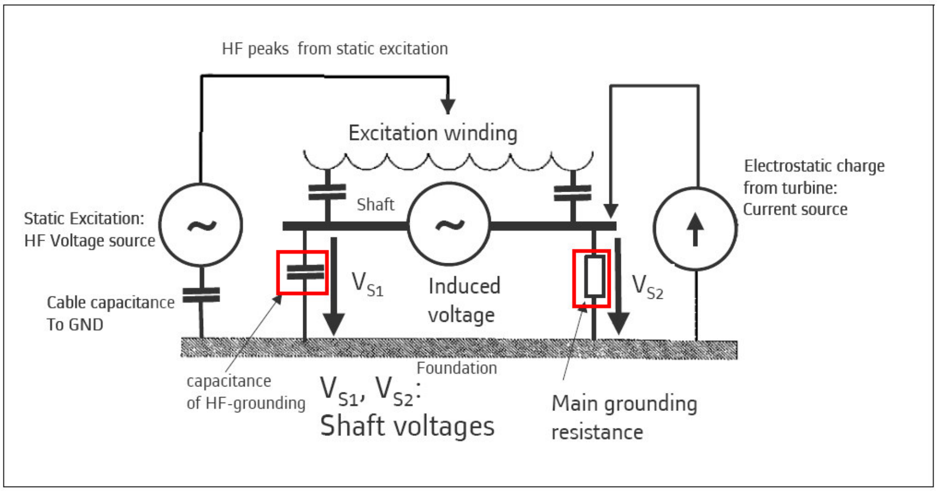
ALSTOM generator diagnostics UK has performed this test on various types of equipment in various scenarios under different fault conditions. Our team can meet your testing requirements if via a forced outage (24hr response time), or as part of a planned outage, surveying all machines in a fleet & providing recommendations on future operations of units.

For further information contact :
David-LSmith@power.alstom.com.

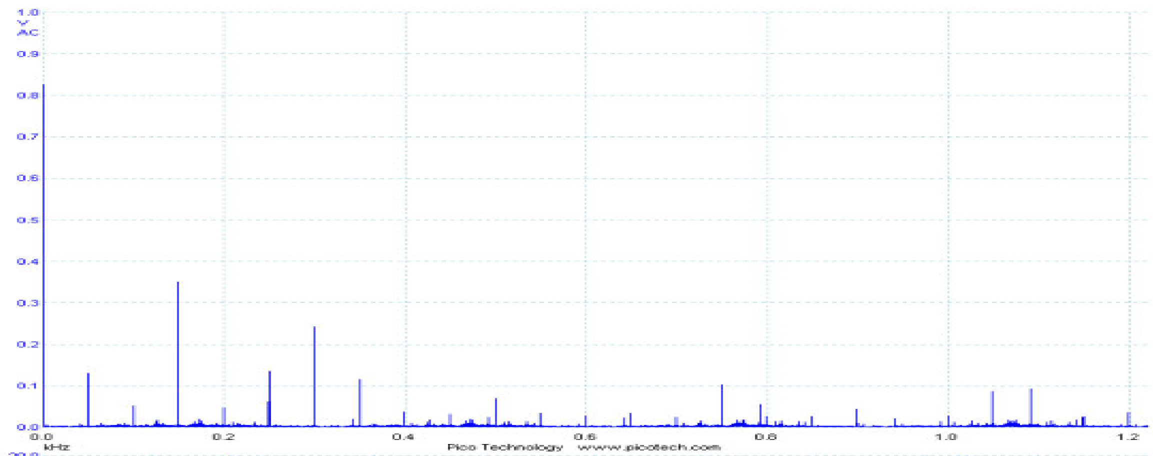
UK Generator Diagnostics

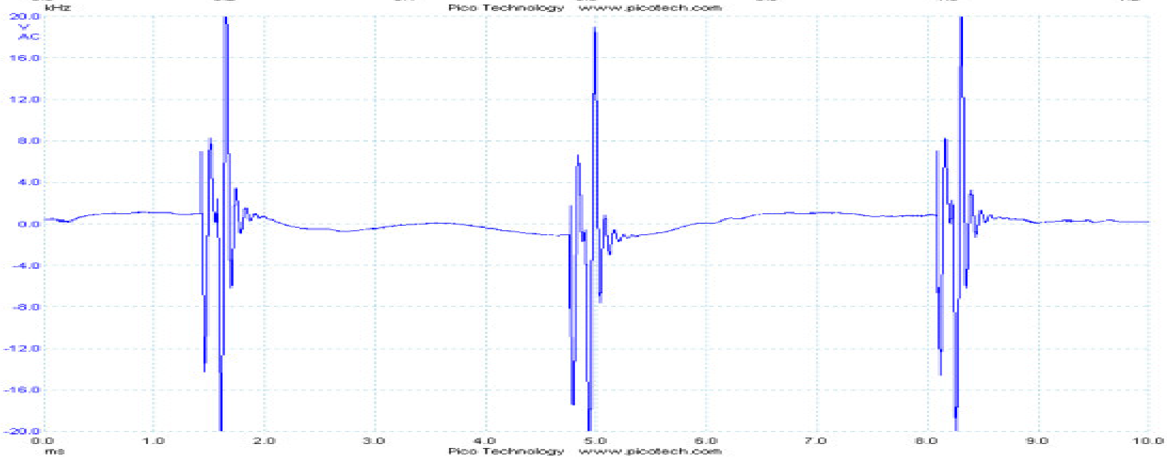
SHAFT VOLTAGE MEASUREMENTS

Induced shaft voltages are a magnitude of the magnetic features / structures that make up the machine.
These voltages are characteristics of the machine and the conditions in which it operates within.
They are influenced by the load type, power levels active and reactive.
Characteristics that are measured can be said to be a magnetic fingerprint of the machine.
The ring flux that is circulating induces an emf (Electro Motive Force). The emf is present in the loop created by the shaft & generator housing, thus potential differences arise.
These rises in voltage are referenced between the shaft & ground potential.



Monitoring of the shaft voltages including harmonics can trend the characteristics.
Working to specific criteria the voltage levels can be tracked & highlight issues before problems occur.
The main issues that can occur are capacitive coupling on the bearing surface area due to rubbing resulting in electro-erosion and pitting.





Monitoring Overview

Benefits from our expertise gained

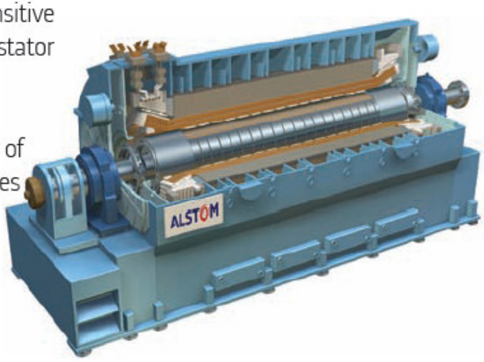
Monitoring Services

Generator operation data: link operation condition to the various monitoring modules indicating load dependent component condition.

Partial Discharge Monitoring: Partial discharge measurement using high sensitive bus couplers indicating weaknesses in stator winding insulation system.

End Winding Vibration: Measurement of end winding vibration indicating changes in stiffness of end winding support system.

Stator bar temperature monitoring TEMPO™: Individual recording of cooling water temperature for H2O cooled machines.



Shaftline vibration monitoring: Vibration recording system for the rotor shaft.

Rotor shaft voltage ROMON®: Shaft voltage measurement indicating rotor winding and shaft grounding condition.

Rotor Insulation Monitoring: Rotor insulation monitoring for machines with brushless exciters using rotor telemetry.

Four levels of monitoring available:

- Level 4: + data connection to central server (e.g. Utility headquarter), extended remote support with Service Centre expertise and continuous data assessment
- Level 3: + permanent equipment, local server, remote access and data assessment on request
- Level 2: + portable equipment, local data collection and periodic data assessment
- Level 1: Sensor, cabling and connection box

Test results and reports: Monitoring results are evaluated remotely in our Local Service Centres / Plant Support Centres. After a detailed evaluation of the results, a report will be prepared for the clients showing a summary of the results and with proposals for medium and / or long-term courses of action.

8. APPENDICES :TEST EQUIPMENT

Handy Scope	HS3	SN: 23220	Cal Due 02/03/13
RSO Sig Gen	MK1	0604-007	Cal Due 24/05/12
Fluke IR Tester	1550B	Hydro 5896	Cal Due (Unknown)

ALSTOM NWE
Generator Diagnostics UK
Lichfield Road
Stafford
ST17 4UJ
Tel: +44(0)1785 274054
Fax: +44(0)1785 274020

www.alstom.com

ALSTOM

Test Certificate	Title *DIRIS*® **low flux measurement on stator core**	Report no.	Enclosure

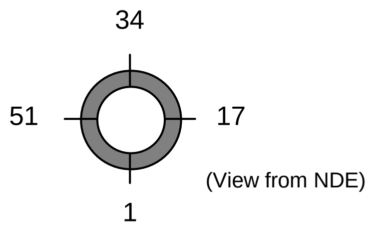
Measurement execution:

Magnetization unit:	C-20050003	Voltmeter:	C-37011430 coil voltage
DIRIS Data Acquisition Unit:	C-99850125	Ampèremeter:	C-37012931 calibration current
Probe:	Pr. Carr. 40 pilot	Rogowski coil	C-04750024

Measurement settings:

Number of windings:	1	Iron length, L [mm]:	3890
Frequency [Hz]:	60	Effective core cross-section, A_{Fe} [m^2]:	1.193
Magnetization voltage [V]:	25	Single turn voltage, U [V]:	25
Magnetisation current [A] :	46	Calculated induction, $\hat{B}_{Mess}$ [T]:	0.0786
Probe speed:	0.4	Number of slots:	66

Data file:	C:\Users\dloosli\Desktop\Holyrood_Inspection\Holyrood_U2_2012_LF.dp3



Measurement results:

Calibration table:

Slot Number	Position from NDE [mm]	Length [mm]	Current [A]	Power at rated induction [W]
1	476	3	1.86	15.2

Fault table:

Slot Number	Position from NDE [mm]	Power at rated induction [W]
No faults were found		

Maximum single permissible lamination short-circuit power dissipation (at rated induction): 15 W

Remarks:

It is unknown if the core packets were connected by a ground bar. This could have an influence on the measurement.

Test Decision (as required/acc. to specification)	**Accepted*** / **NC-Report***	**Rejected*** / **Rework***	Unit / System Name Holyrood2			
NCR No.*			Part Text ATB2POLES60CYCLES			Quantity
Checked by**			Part Idnr 980486	Rev.	Power Station Designation	
Approved by**			I & T Plan ID	Rev.	Test Step	Material Test No.
Authority / Customer**			Order No.		Factory Order	
ALSTOM			Sheet No. 1	No. of Sh. 1	Document No. **HTCZ656981**	Rev. **-**

* Mark/Fill in if applicable ** Name / dept. / date / initials

PAL
TURBINE SERVICES, LLC

Hydro NL / Alstom Power
Holyrood, Newfoundland

Troubleshoot Unit Control Issues and Test
Feb 14 – 16, 2012

Turbine Serial Number
191641

PAL Job # 12-1465

Prepared By: PAL Turbine Services, LLC
Tom Huff
Control Systems & Startup Specialist

Table of Contents

Unit Identification

Turbine Nameplate Data:

Turbine Serial Number:	191641
Generator Serial Number:	162861-1
Unit Rated Load:	150 mw
Service Year:	1978

Introduction

The writer arrived onsite Tuesday morning (Feb 14) and met with Johns Adams, Alstom Senior Technical Service Advisor for Hydro NL.

Unit #3 was online at 145 mw.

Attended a kick-off meeting with John Adams (Alstom); and Paul Woodford, Christian Thangasamy, Bob Garland, Bill Kilfoy, Val Corbett, Bob Pretty, Evan Cabot, and Jim McNeill of Hydro NL. Discussed ongoing unit control issues and testing plan.

Planned Work Scope

Investigate factors as to why unit load changes (valve movements) are not linear in some areas of the 120 – 150 mw range.

Obtain unit operating data pertaining to:
1 Unit Load (mw)
2 Load limit position (%)
3 Speed relay stroke (mils)
4 Control valve operating cylinder stroke (%)
5 Control valve operating cylinder opening and closing oil pressures (psig)
6 Control valve cam angle (degrees)
7 Control valve #3 stroke (mils)

Work Summary

The first series of tests were conducted on Tuesday (2/14). Beginning at 147 mw, unit load was gradually decreased by manually turning the local load limit handwheel at the turbine front standard in precise amounts (1/8 CW). The seven operating data points listed above were recorded for each 1/8 turn of the handwheel until unit load decreased to 110 mw. Refer to the data sheet in the attachment section of this report (page 8).

Manually turning the local load limit handwheel in precise increments enabled a more controlled method to decrease unit load as opposed to using the load limit pistol grip controller in the control room, which varied a little due to the length of time the pistol grip was being actuated.

Then, beginning at 110 mw, load was increased by manually turning the local load limit handwheel in precise 1/8 turn increments in the load increase direction (CCW). The seven operating data points were recorded again for each 1/8 turn of the handwheel up to 147 mw. Refer to the data sheets in the attachment section of this report (page 8).

Work Summary Continued

The tests were repeated, using the pistol grip controller in the control room, and the same operating parameters recorded. Refer to the data sheet in the attachment section of this report (page 9).

Next day (2/15), the tests were repeated between 100 – 147 mw, in both directions, and operating data recorded. Refer to the data sheet in the attachment section of this report (pages 10 and 11)

Test Data Analysis

Referring to the recorded data, it can be seen that nonlinear and repeatable load jumps occurred primarily in the 120 – 140 mw range, in both increasing and decreasing load changes. Also, when comparing the opening and closing oil pressures of the control valve operating cylinder in the 120 – 140 mw range, it can be seen that in a couple of areas the differential oil pressures (cylinder opening vs. closing) tend to increase as the load limit handwheel is moved a couple of times without any movement of the control valve operating cylinder itself; then the operating cylinder will suddenly move, resulting in load jumping 7 – 13 mw. This indicates possible mechanical binding in the control valve gear.

Also, it should be noted that when looking at the design valve curves, the 120 – 150 mw load range is in initial steep portion of #3 valve curve, which would somewhat magnify any control device irregularities that was occurring in this region.

Future Planned Work Scope

To determine what is the root cause(s) of the control (load) irregularities, whether in one or more of the turbine front standard control devices, in the control valve (CV) operating cylinder, and/or in the CV assemblies, plans are to mechanically disconnect the CV operating cylinder from the valve linkage. In this way, the front standard components can be stroked individually (load limit, speed relay and CV operating cylinder); and the upper and lower control valves can be stroked individually. This investigative work to be performed when the unit is in isochronous operating mode (turbine disconnected from the generator, with the hydraulic oil system in service).

Depending upon what root cause(s) are identified (there could be more than one), either one or more of the turbine front standard devices and/or in the control valve assemblies, further work may be necessary, up to and including partial front standard disassembly and/or partial control valve disassembly.

In addition, during this time, plans are to rebuild the speed relay and possibly replace the clutch in the load limit device.

Conclusion

Released the unit for normal operation when the testing was completed.

The writer would like to thank Hydro NL and Alstom Power for this opportunity to be of service. Please call or email PAL Turbine Services, LLC if you have any questions.

Parts Used

None

Attachments

Date: 14-Feb
Test: Decreasing Load

Load Limit Handwheel Movement	Unit Load (mw)	Load Limit Position (%)	Speed Relay Movement (mils)	CV Cylinder Position (%)	CV Cam Shaft Angle Degrees
Start Test	146	77.5	0	86.0	215
1/8 CW	146	77.0	0	87.0	215
1/8 CW	146	76.0	0	87.0	215
1/8 CW	140	75.0	-35	86.0	210
1/8 CW	126	74.0	-105	83.0	200
1/8 CW	121	73.0	-135	80.5	195
1/8 CW	119	72.5	-160	79.5	190
1/8 CW	115	71.5	-185	78.0	188
1/8 CW	112	70.5	-205	76.0	184
1/8 CW	110	70.0	-230	75.0	180

Date: 14-Feb
Test: Increasing Load

Load Limit Handwheel Movement	Unit Load (mw)	Load Limit Position (%)	Speed Relay Movement (mils)	CV Act Position (%)	CV Cam Shaft Angle Degrees	CV Act Opening Oil Press (psig)	CV Act Closing Oil Press (psig)
Start Test	110	70.0	-230	75.0	180	85	143
1/8 CCW	110	70.5	-205	75.0	184	105	122
1/8 CCW	111	71.5	-180	75.0	187	117	110
1/8 CCW	114	73.0	-150	76.5	190	122	108
1/8 CCW	118	73.5	-80	78.0	195	122	110
1/8 CCW	131	75.0	-40	83.0	206	118	112
1/8 CCW	133	75.0	-40	83.0	206	118	110
1/8 CCW	138	77.0	-35	84.0	210	119	109
1/8 CCW	145	77.5	0	86.0	215	115	113

Attachments

Date: 14-Feb
Test: Increasing Load

Pistol Grip Actuation	Unit Load (mw)	Load Limit Position (%)	Speed Relay Movement (mils)	CV Cylinder Position (%)	CV Cam Shaft Angle Degrees	CV Cylinder Opening Oil Press (psig)	CV Cylinder Closing Oil Press (psig)
Start Test	122	73.5	0	80.5	195	102	125
1 pulse up	132	74.5	50	82.0	205	111	127
1 pulse up	136	77.0	90	84.0	210	119	114
1 pulse up	143	77.5	115	85.5	215	115	112

Date: 14-Feb
Test: Decreasing Load

Pistol Grip Actuation	Unit Load (mw)	Load Limit Position (%)	Speed Relay Movement (mils)	CV Cylinder Position (%)	CV Cam Shaft Angle Degrees	CV Cylinder Opening Oil Press (psig)	CV Cylinder Closing Oil Press (psig)
Start Test	144	76.5	115	86.0	215	115	114
1 pulse down	144	75.0	105	86.0	215	81	138
1 pulse down	125	74.0	80	82.0	200	111	117
1 pulse down	119	73.0	50	80.0	195	95	133
1 pulse down	117	72.0	25	78.0	190	95	133

Attachments

Date: 15-Feb

Test: Decreasing Load

Load Limit Handwheel Movement	Unit Load (mw)	Load Limit Position (%)	Speed Relay Movement (mils)	CV Act Position (%)	CV Cam Shaft Angle Degrees	CV-3 Movement (mils)	CV Act Opening Oil Press (psig)	CV Act Closing Oil Press (psig)
Start Test	147	78.0	0	87.0	220	1335	134	96
1/8 CW	147	77.0	0	87.0	220	1334	133	98
1/8 CW	147	76.5	-5	87.0	220	1324	105	125
1/8 CW	139	75.5	-50	86.5	210	1218	90	141
1/8 CW	126	74.5	-110	83.0	200	1046	113	117
1/8 CW	121	73.0	-145	80.5	195	981	97	134
1/8 CW	116	72.5	-168	79.0	190	948	94	137
1/8 CW	112	72.0	-193	77.5	189	917	86	145
1/8 CW	110	70.5	-217	76.0	184	899	88	142
1/8 CW	108	70.0	-243	75.0	180	894	86	144
1/8 CW	107	69.0	-265	73.5	177	897	84	147
1/8 CW	105	68.0	-290	72.0	174	896	82	150
1/8 CW	102	67.0	-315	70.5	170	896	88	152
1/8 CW	99	66.0	-340	68.5	165	905	77	157
1/8 CW	95	65.0	-365	67.0	160	912	76	157

Attachments

Date: 15-Feb

Test: Increasing Load

Load Limit Handwheel Movement	Unit Load (mw)	Load Limit Position (%)	Speed Relay Movement (mils)	CV Act Position (%)	CV Cam Shaft Angle Degrees	CV-3 Movement (mils)	CV Act Opening Oil Press (psig)	CV Act Closing Oil Press (psig)
Start Test	99	66.0	0	69.0	165	911	80	155
1/8 CCW	99	67.0	25	69.0	170	897	110	123
1/8 CCW	103	68.0	55	69.5	172	900	110	119
1/8 CCW	105	69.0	125	71.0	176	890	107	112
1/8 CCW	107	70.0	200	72.5	180	895	109	120
1/8 CCW	108	71.0	225	74.0	184	891	109	111
1/8 CCW	111	72.0	245	75.5	187	910	119	113
1/8 CCW	113	72.5	270	76.5	190	924	125	108
1/8 CCW	117	73.0	295	78.0	195	969	122	107
1/8 CCW	131	74.5	365	82.5	206	1128	120	110
1/8 CCW	132	75.5	365	83.0	206	1128	117	114
1/8 CCW	135	76.5	385	84.0	210	1174	120	110
1/8 CCW	140	77.5	410	86.0	215	1239	118	112
1/8 CCW	147	78.5	435	87.0	220	1342	130	100

ALSTOM RECORD SHEET **Inspection/Assembly** Page **1**

Title	**Speed Relay Inspection and Repair**								
Contract	**Holyrood Generating Station**		Unit	**Unit 3**		Serial No.	**191641**		
Taken by	**B. Corcoran**	Date	**8/7 – 8/8/12**	Supvr.	**G. Lannon**	Approv.	**RM Scott**	Date	**8/10/12**

Ref. Drawing: -

The customer requested Alstom Power, Inc., to provide manpower and supervision to remove the speed relay on their Unit 3 Hitachi Steam Turbine and install a new piston and guide bushing as recommended from previous inspection report. The unit was secured and turned over to Alstom Power on August 7 and was returned to the Customer on August 8 for return to service.

The following outlines the work performed during this outage:

The speed relay was removed, disassembled and as found measurements were recorded. The speed relay cylinder was found to be tapered .001" from top to the bottom and had scratches in the bore that could cause the piston to stick under certain conditions. The cylinder was honed on-site to remove the scratching in the bore and to remove the taper.

The piston was removed, visually inspected and measured. Scratching was noted on the o.d. of the piston and evidence of the piston riding to one side of the bore. A new piston had been ordered by the customer with additional stock on the outside diameter. The piston was taken to a local machine shop, and machined to allow .002"/.004" clearance between the piston outside diameter and the cylinder inside diameter.

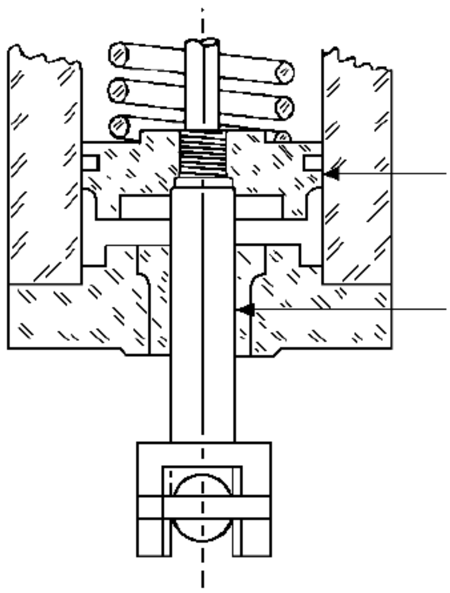
The Upper bushing was removed and replaced as the bore of the bushing was found to be out of round by .005"/.006". The new bushing was bored to allow .001"/.003" clearance to the stem and installed.

The speed relay was reassembled and installed

Speed Relay

Date (m/d/y) 8/8/12 Turbine Serial No. 191641 Prepared by RM Scott

INSPECTIONS & CHECKS				CODE	
Dimensional Checks	x			X	Work Carried Out
				N	Not Done
				NA	Not Applicable
				C	See Comments
				V	Visual Inspection
				MP	Mag. Particle
				UT	Ultrasonic
				PT	Penetrant



Clearances - As Found

Relay	X	Y
Cylinder Bore - Top	3.3855	3.3850
Cylinder Bore - Mid	3.3860	3.3850
Cylinder Bore - Bot	3.3860	3.3850
Piston	3.3790	3.3790
Clearance	0.0065	0.0060
Bushing Bore	1.8240	1.8290
Stem	1.8210	1.8210
Clearance	0.0030	0.0080

Clearances - As Assembled

Relay	X	Y
Cylinder Bore - Top	3.3860	3.3865
Cylinder Bore - Mid	3.3860	3.3865
Cylinder Bore - Bot	3.3860	3.3865
Piston	3.3840	3.3840
Clearance	0.0020	0.0025
Bushing Bore	1.8240	1.8290
Stem	1.8210	1.8210
Clearance	0.0030	0.0080

Comments

Cylinder bore was cleaned and Honed
New piston machined and installed
New bushing machined and installed