

**TAMILNADU GENERATION DISTRIBUTION CORPORATION
LTD.(TANGEDCO)
1X800 MW NORTH CHENNAI COAL BASED STPP STAGE-III**

**TECHNICAL SPECIFICATION
FOR
VIBRATION ISOLATION SYSTEM
FOR**

TG (1 NOS) FOUNDATION

SPECIFICATION NO. : PE-TS-423-613-C001 (Rev 0)



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA-201301**



TITLE :
TECHNICAL SPECIFICATION FOR
VIS FOR TG (1 NOS) FOUNDATION

SPECIFICATION NO. PE-TS-423-613-C001

SECTION

REV. NO. 0

DATE 13.09.2016

CONTENTS

This Technical Specification consists of two Sections:

SECTION I

- SPECIFIC TECHNICAL REQUIREMENTS.

SECTION II

- STANDARD TECHNICAL SPECIFICATION.
- REFERENCE QUALITY PLAN



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COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

01. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.
02. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations.'
03. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
04. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
05. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ-Cum-Price schedule' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).
06. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.

The charges for 3rd party inspection (Lloyds, or equivalent) for imported components shall be included in the base price of the equipment by the bidder.

07. All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval.
08. GA drawings/ datasheet / QP as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
09. All sub vendors shall be subject to BHEL/CUSTOMER approval.
10. Any special tools & tackles, if required, shall be in bidder's scope.



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SECTION-I

SPECIFIC TECHNICAL REQUIREMENTS



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1.0 SCOPE

1.01 SUPPLY OF VIBRATION ISOLATION SYSTEM (VIS):

- i) Vibration Isolation System (VIS)
- ii) Tools and facilities required for erection and commissioning including seaworthy packing & transportation etc. complete.

1.02 SUPERVISION OF ERECTION AND COMMISSIONING OF THE VIS.

Vendor shall deploy experienced manpower for setting the VIS in position and final adjustments after machine installation. Vendor shall also confirm the readiness at site before deploying the manpower for supervision of erection. Vendor shall furnish proposed erection strategy of the entire system and procedure for replacement of VIS and downtime involved.

1.03 DESIGN & ENGINEERING FOR THE VIBRATION ISOLATION SYSTEM AND TOP DECK (INCLUDED IN VENDOR'S SCOPE)

Design and engineering shall consist of the following:

- i) Selection of Vibration Isolation System (VIS).
- ii) Static and dynamic analysis and design of RCC deck slab (supporting arrangement for the equipment supported on VIS)
- iii) Calculation of loads on supporting structure along with their points of application and deflection limitations.
- iv) Calculation should establish that not more than 10 % of the dynamic loads are transmitted to the substructure supporting VIS and that the foundation system meets the amplitude/frequency requirements.
- v) Checking of stiffness for structure supported on VIS.

1.04 DOCUMENTATION

Vendor shall furnish following documents:

- i) Bill of materials of various elements included in the supply along with detailed specifications of system and various items included in supply and standards local or international standards to which they conform.
- ii) General Arrangement (GA) drawing showing location and supporting details of VIS. **(Included in vendor's scope).**
- iii) GA and reinforced concrete details drawings for deck slab including bar bending schedule. **(Included in vendor's scope).**
- iv) Embedment drawings showing location of all embedment and their details pertaining to RCC deck slab-**(Included in vendor's scope).**
- v) Design document. **(Included in vendor's scope).**
- vi) Methodology of providing the shuttering and its removal as well as concreting of deck slab, installation of VIS and sequence of above operation.
- vii) Installation and maintenance manual indicating equipment, procedures, etc. necessary for installation/maintenance of VIS.
- viii) List of power plants where such systems have been successfully installed for such applications.
- ix) Performance certificate from the end user/customer for at least two successfully executed contracts for such system.



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2.0 GENERAL:

- 2.1 In case of any conflict between section –I and section-II, section-I will prevail over section-II.
- 2.2 Vibration Isolation system (VIS) shall consist of steel helical springs and viscous damper.
- 2.3 The isolation efficiency of the foundation system comprising RCC deck and steel helical springs shall be at least 90%.
- 2.4 The ratio of actual spring supported weight to the nominal spring capacity shall be at least 0.8.
- 2.5 At least 3% to 5% of critical damping shall be provided in the form of viscous dampers.
- 2.6 Bidder shall quote based on the input drawings as per Table-1 to satisfy the design requirement as per the relevant applicable codes in annexure- A and section - II.

Table-1

<u>Sl. No</u>	<u>TITLE</u>	<u>DRAWING NO.</u>
1	LOAD ON FOUNDATION (SH ½)	0-13100-V6151 (R0)
2	LOAD ON FOUNDATION (SH 2/2)	0-13100-V6151 (R0)
3	FOUNDATION PLAN TOP VIEW, SECTION A-A (SH ½)	0-13100-V6152 (R0)
4	FOUNDATION PLAN TOP VIEW, SECTIONS (SH 2/2)	0-13100-V6152 (R0)
5	FOUNDATION PLAN SECTIONS	0-13100-V6153 (R0)
6	FOUNDATION PLAN BOTTOM VIEW	0-13100-V6154 (R0)
7	LIST OF TG DECK EMBEDMENTS	0-13100-V6155 (R0)

- 2.7 Bidder shall furnish the information about the entire range of spring units, damper units and spring cum damper units, manufactured by the vendor. The information to be furnished should include the load carrying capacity, stiffness (vertical & horizontal), damping resistance, dimension of spring and damper units as well as quality plan.

- 2.8 The steel helical springs and viscous damper supplied should be of proven make.

3.0 DOCUMENTS TO BE SUBMITTED BY VENDOR

- 3.1 Document submission schedule after the award of contract shall be as below:



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PACKAGE	BHEL DRG NO	DRG TITLE	Drg Submission schedule
VIS FOR TG	Primary Documents - affecting Manufacturing/ Delivery Directly		
	PE-V0-423-613-C201	Data sheet of TG Foundation	R-0 within Two (02) weeks from LOI/PO & subsequent revisions within 10 days of comments received from BHEL/customer.
	PE-V0-423-613-C202	QAP FOR TG Foundation	
	PE-V0-423-613-C203	Test certificate of TG Foundation	
	PE-V0-423-613-C204	Static & dynamic Analysis of TG Foundation	
	PE-DG-423-613-C011	GEN ARRANGEMENT OF SPRING SUPPORTED T/G DECK FDN	
	Secondary Documents - NOT affecting Manufacturing / Delivery Directly		
	PE-DG-423-613-C010	T.G FDN.-GA OF TOP DECK: LIST OF EMBEDMENT	R-0 within Two (02) weeks of Cat-I(or)II approval on GA drawing
	PE-DG-423-613-C012	TG FDN TOP DECK - RC DET OF BEAM 1&2	
	PE-DG-423-613-C013	T/G FDN TOP DECK-RC DET OF BEAM 1& 2	
	PE-DG-423-613-C014	T/G FDN TOP DECK-RC DET OF BEAM 3 & 4	
	PE-DG-423-613-C015	T/G FDN TOP DECK-RC DET OF BEAM 3 & 4	
	PE-DG-423-613-C016	T/G FDN TOP DECK-RC DET OF BEAM 6, 12 & 13	
	PE-DG-423-613-C017	T/G FDN TOP DECK-RC DET OF BEAM 7 & 8	
	PE-DG-423-613-C018	T/G FDN TOP DECK-RC DET OF BEAM 9, 10 & 11	
	PE-DG-423-613-C019	TG FDN TOP DECK - RC DET OF BEAM 5	
	PE-DG-423-613-C020	T/G DECK FOUNDATION (LONGITUDINAL BEAM -7) PART 1/3	
	PE-DG-423-613-C021	T/G DECK FOUNDATION (LONGITUDINAL BEAM -7) PART 2/3	
	PE-DG-423-613-C022	T/G DECK FOUNDATION (LONGITUDINAL BEAM -7) PART 3/3	
	PE-DG-423-613-C023	T/G DECK FOUNDATION (LONGITUDINAL BEAM -9) PART 1/3	
	PE-DG-423-613-C024	T/G DECK FOUNDATION (LONGITUDINAL BEAM -9) PART 2/3	
	PE-DG-423-613-C025	T/G DECK FOUNDATION (LONGITUDINAL BEAM -9) PART 3/3	
	PE-DG-423-613-C026	T/G DECK FOUNDATION (LONGITUDINAL BEAM -8) PART 1/6	
	PE-DG-423-613-C027	T/G DECK FOUNDATION (LONGITUDINAL BEAM -8) PART 2/6	
	PE-DG-423-613-C028	T/G DECK FOUNDATION (LONGITUDINAL BEAM -8) PART 3/6	
	PE-DG-423-613-C029	T/G DECK FOUNDATION (LONGITUDINAL BEAM -8) PART 4/6	
	PE-DG-423-613-C030	T/G DECK FOUNDATION (LONGITUDINAL BEAM -8) PART 5/6	
	PE-DG-423-613-C031	T/G DECK FOUNDATION (LONGITUDINAL BEAM -8) PART 6/6	
	PE-DG-423-613-C032	T/G DECK FOUNDATION (LONGITUDINAL BEAM -10) PART 1/6	
	PE-DG-423-613-C033	T/G DECK FOUNDATION (LONGITUDINAL BEAM -10) PART 2/6	
PE-DG-423-613-C034	T/G DECK FOUNDATION (LONGITUDINAL BEAM -10) PART 3/6		
PE-DG-423-613-C035	T/G DECK FOUNDATION (LONGITUDINAL BEAM -10) PART 4/6		
PE-DG-423-613-C036	T/G DECK FOUNDATION (LONGITUDINAL BEAM -10) PART 5/6		
PE-DG-423-613-C037	T/G DECK FOUNDATION (LONGITUDINAL BEAM -10) PART 6/6		
PE-DG-423-613-C038	T/G DECK FOUNDATION (LONGITUDINAL BEAM -11 & 12)		
PE-DG-423-613-C039	T/G DECK FOUNDATION -- BAR BENDING SCHEDULES		

3.2 The documents shall be submitted as mentioned below:

- Soft copy of all documents/drawings shall be furnished in pdf and AutoCAD format as applicable.
- Hard copies shall also be submitted.
- Submission of civil drawings/documents shall be as mentioned in the table-2.



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Table-2

	Drawing	Document
For Approval	Soft copy + 10 nos. hard copies	Soft copy + 10 nos. hard copies
For RFC	Soft copy + 8 nos. hard copies	

4.0 SEISMIC LOADING:

The seismic zone shall be Zone-III as per IS 1893.Importance factor (1.75) shall be taken as Table 2 of IS 1893: Part4 & response reduction factor will be taken from Table 7 of IS: 1893-2002 with 100% of mass participation. Ductile detailing in accordance with IS 13920 shall be adopted for all concrete structures which is mandatory for zone-III. Response spectrum method shall be used for seismic analysis sufficient mode of vibration.

Zone factor: 0.16

Importance factor: 1.75

5.0 WIND LOADING:

Wind loading will be in accordance with Indian Standard Code IS: 875 (Part 3). Basic wind speed shall be 50 m/sec. Terrain Category-2 shall be considered for all structures.

6.0 MATERIAL OF CONSTRUCTION

- Minimum grade of concrete: M30.
- Reinforcing bars will be TMT bars of grade Fe500 conforming to IS-1786.

7.0 MATERIAL (DESIGN & SUPPLY)

7.1 Steel helical springs and viscous dampers shall consist of:

- Steel helical spring units and viscous dampers along with viscous liquid including associated auxiliaries for installation of the spring units and dampers like steel shims, adhesive pads, etc.
- Frames for pre-stressing of spring elements.
- Suitable hydraulic jack system including electric pumps, high pressure tubes etc. required for the erection, alignment etc. of the spring units. One set of extra hydraulic jacks, and hand operated pumps shall also be provided.
- Any other items may be required for the pre-stressing, erection, release of pre-stress, alignment and commissioning of the steel helical springs and viscous dampers.

7.2 The sizes of the spring units, damper units, spring cum damper units should be such that groups of such units can be accommodated on column heads in case of elevated foundations and on pedestals/walls in case of foundations at ground level.

7.3 The steel helical springs and viscous dampers shall be designed for ensuring "fit and forget" guarantee.

8.0 MANUFACTURING & TESTING

8.1 Complete manufacturing and testing of the steel helical springs and viscous dampers shall be done at the manufacturing shop of the vendor. For this purpose the vendor shall submit the detailed



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programme for approval of customer and take up the manufacturing / testing after approval of such programme. The programme (quality plan) shall include:

- i. Manufacturing schedule and quality check exercised during manufacturing.
- ii. Detail of test to be carried out at the manufacturing shop with its schedule.
- iii. Special requirements, if any, regarding concreting of top deck.
- iv. Complete step- by- step procedure covering the installation and commissioning of the spring system.
- v. Manuals for erection, commissioning, testing and maintenance of the steel helical springs and viscous dampers.
- vi. A checklist for confirming the readiness of the civil fronts for erection of steel helical springs and viscous dampers.
- vii. Checklist for equipment required at each stage of erection.
- viii. Bill of materials (data sheet) of various elements such as spring units, viscous dampers, with their rating, stiffness etc. included in the supply.
- ix. Bill of material (data sheet) for frames for pre stressing, hydraulic jack including electric pump, high pressure tubes, hand operated pump etc. with their rating and numbers.
- x. Any other details which may be necessary to facilitate design and construction of the foundations / structures.

8.2 The springs shall conform to codes DIN 2089 and DIN 2096. The quality assurance and inspection procedure shall be finalised on the basis of the above codes and the quality plans be drawn accordingly.

9.0 ERECTION AND COMMISSIONING AND SUPERVISION

- 9.1 Complete erection and commissioning of the steel helical springs and viscous dampers including pre-stressing of elements, placing of elements in position, checking clearances on the shuttering of the RCC top deck, releasing of pre-stress in spring elements, making final adjustments and alignments etc. all shall be supervised by a specialist supervisor.
- 9.2 The scope of work shall be deemed to include all activities, which may not have been explicitly mentioned but are reasonably implied for the successful commissioning of steel helical springs and viscous dampers.

10.0 REALIGNMENT OF SPRING SYSTEM

If any realignment of the steel helical springs and viscous dampers is required to be done for aligning the shaft or for any other reasons during the first one year of operation from the date of commissioning of the machine, the same shall be done by the vendor.

11.0 TRANSPORTATION

- 11.1 Steel helical springs and viscous dampers shall be suitably protected, coated, covered, boxed and crated to prevent damage or deterioration during transit and handling.
- 11.2 The vendor shall be responsible for any loss or damage during transportation, handling.

12.0 INSPECTION REQUIREMENTS

- 12.1 Minimum requirement for quality plan shall be as per quality plan attached in section –II of the specification. Quality plan shall be subject to approval during detail engineering. No price implication shall be admissible to QP approval by BHEL/Customer.



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- 12.2 Inspection for imported item shall be done from third party like Lloyd or equivalent and certificate shall be submitted for review of BHEL.
- 12.3 In case of new bidder, bidder may need to carry out damping test, stiffness test etc. during customer approval stage before price bid opening. No price implication shall be admissible for these tests.

ANNEXURE-A

Codes and Standards

Latest revision of following codes shall be used for the design of the spring-supported foundations:

IS: 456	Codes practice for plain and reinforced concrete.
IS: 2974	Code of practice for design and construction of machine foundations.
IS: 1893	Criteria for earthquake resistant design of structures.
DIN: 4024	Machine foundations; Flexible supporting structures for machine with rotating masses
DIN: 2089	Helical compression springs out of round wire and rod: calculation & design.
DIN: 2096	Helical compression springs out of round wire and rod: quality requirements for hot formed compression springs.
VDI: 2056	Criteria for assessing mechanical vibrations of machine.
VDI: 2060	Criteria for assessing the state of balance of rotating rigid bodies.



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SECTION-II

STANDARD TECHNICAL SPECIFICATION

AND

REFERENCE QUALITY PLAN



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1.0 SCOPE :

This section covers supply, supervision of erection commissioning & design engineering of the vibration isolation system (VIS) suitable for ID/PA/FD Fans/ TDBFP/MDBFP/ TURBOGENERATORS/ MILLS. The vibration isolation system shall be of proven make and should be in successful operation for similar machines.

2.0 SUPPLY OF VIBRATION ISOLATION SYSTEM (VIS)

VIS shall be supplied complete along with recommended spares if any. The selection of VIS shall be done by the vendor, in case not done by customer so that the amplitude at bearing locations are within permissible limits as per machine supplier recommendation or ISO 10816 whichever is governing and no dynamic loads are transferred to structure supporting VIS. Minimum 90% isolation shall be achieved and the system shall be capable of withstanding Seismic/Wind forces.

3.0 SUPERVISION OF ERECTION AND COMMISSIONING

3.01 Manual

Vendor shall supply installation and maintenance manual indicating equipment procedures etc. necessary for installation and replacement of VIS with downtime involved.

3.02 Tools and facilities

Vendor shall supply all tools and facilities as required for successful erection and commissioning of VIS. Vendor shall deploy experienced manpower to supervise successful installation of VIS.

4.0 DESIGN ENGINEERING OF VIBRATION ISOLATION SYSTEM

4.01 Dynamic Analysis

The dynamic analysis shall consist of free vibration analysis and forced vibration analysis. Isolation efficiency of at least 90% shall be obtained. The fundamental natural frequency shall be sufficiently above or below the frequency corresponding to operating speed. Vibration amplitude shall be calculated at all bearing locations and shall satisfy the permissible limits as per ISO 10816 or as specified by the machine supplier. Transient analysis shall be carried out for the short circuit / blade failure condition with an appropriate force function if required by the machine supplier. The forces for which substructure is to be designed shall be furnished.

4.02 Static Analysis

The static analysis shall include the

- a) Dead weights of machine stationary parts
- b) Dead weights of machine rotary parts
- c) Loads due to machine power torque
- d) Loads due to maximum allowable unbalance
- e) Temperature loads
- f) Loads due to blade unbalance/short circuit
- g) Erection loads
- h) Seismic loads
- i) Any other loads given by the supplier



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Various loads combinations must be investigated to obtain the most severe loads for foundation design purpose as per relevant IS codes or as per machine supplier recommendation whichever is more critical.

4.03 CHECK FOR SHAFT MISALIGNMENT

Foundation deck must be adequately stiff to withstand all operating load combinations without excessively upsetting the rotor shaft alignment. The structural design must carefully be analysed for relative deflection for the members supporting machine shaft to satisfy the limits as given by machine supplier if any.

4.04 DESIGN OF RCC DECK SUPPORTED ON VIS

Vendor shall provide General arrangement drawing of deck showing location and supporting detail of VIS, all embedment and their details as per the machine supplier drawing.

RCC design shall be done by working stress method for all machine foundations. Minimum reinforcement shall be governed by IS: 2974 as well IS:456.

All documents/drawings shall be supplied in 25 (twenty five) prints. All calculations shall be supplied in 6 (six) sets. Soft copy of the drawings in Auto Cad shall be supplied along with the soft copy of the documents supplied. All documentation shall be in English language and all RCC/structural design shall be conforming to the relevant Indian Standard Code of practice.

5.0 QUALITY PLAN AND TEST CERTIFICATE

Vendor shall furnish the quality plan and Test certificate for the hardware in their scope of supply. The quality plan shall be reviewed by BHEL/Consultant wherein the inspection and hold points shall be indicated. Vendor shall submit test certificate based on approved quality plan. Despatch of material by the vendor shall only take place after the receipt of Material Dispatch Clearance Certificate (MDCC) issued by BHEL/Consultant on the basis of test reports/test certificates submitted by the Vendor after manufacture.

6.0 ENVIRONMENTAL PROTECTION

VIS shall be suitably protected against environmental damages e.g. abrasion, discolouration, corrosion, oily water etc. to give a prolonged service matching the plant life.

REFERENCE QUALITY PLAN

		MANUFACTURER'S NAME AND ADDRESS		QUALITY PLAN														
				ITEM: Equipment: Spring Units Type: Spring Units Type:				QP NO.: Rev: Date: Page :		SIGN. OF MFGR'S		QP NO.: REV. NO.: PAGE 1 OF 2			Reviewed by:		Approved by:	
												PROJECT: Contract No:						
Sl. No	Component & Operations	Characteristics	Class	Type of Check	Quantum of Check		Reference Document	Acceptance Norms	Format of Record	Agency				Remarks				
					M	C/N							M		C	B		
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.	11.					
1	Materials / Material																	
1.1	Steel plate	Chemical/Mechanical	Major	Verify	1/heat	--	DIN EN 10025	DIN EN 10204 2.2	Certificate	✓	V	V	V					
1.2	Steel tube	Chemical/Mechanical	Major	Verify	1/lot	--	DIN EN 10305-1 & DIN EN 10220	DIN EN 10204 2.2	Certificate	✓	V	V	V					
1.3	For Springs	Chemical /Mechanical	Major	Verify	1/lot	--	DIN EN 10089	DIN EN 10204 3.1	Certificate	✓	V	V	V					
2	Dimensions																	
2.1	Adhesive pads, jute	Dimensions (mm)	Minor	Measure / Visual	1%	--			Without	-	P	-	-					
2.2	Spring Boxes	Dimensions (mm)	Major	Measure	10%	--	Drawing	EN ISO 13920 C	Without	-	P	-	-					
3	Inspection /																	
3.1	Welding	Visual (mm)	Major	Measure / Visual	10%	--	Annexure-1	Same as column '7'	Certificate	✓	P	V	V					
3.2	Shot Blasting	Picture	Major	Compare	1%	--	EN ISO12944-4 or equivalent	SA – 2 ½	Without	-	P	-	-					
3.3	Painting	Thickness (µm)	Major	Measure / Visual	1%	--	Annexure-2	Same as column '7'	Certificate	✓	P	V	V					

		MANUFACTURER'S NAME AND ADDRESS		QUALITY PLAN														
				ITEM : Equipment: Spring Units Type: Spring Units Type:				QP NO.: Rev : Date : Page :		SIGN. OF MFGR'S		QP NO.: REV. NO.: PAGE 2 OF 2			Reviewed by:		Approved by:	
												PROJECT: Contract No:						
Sl. No	Component & Operations	Characteristics	Class	Type of Check	Quantum of Check		Reference Document	Acceptance Norms	Format of Record	Agency			Remarks					
					M	C/N					M	C	B					
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	**	10.		11.				
3.4	Spring Constant Vertical (elements)	(kN/mm)	Critical	Test	10 %	--	DIN 2096	Approved Data Sheet	Certificate	✓	P	V	V					
3.5	Viscoliquid (For VISCO DAMPER type only / as applicable)	mm/s	Major	Viscosity/ Penetration speed	1/lot 1 Test	--	DIN 53019 or équivalent	Tolerance = ± 20%	Certificate	✓	P	V	V					
3.6	Document Compilation	Vérification	Major	Compare	100 %	--	as per column 7 in above	as per column 8 in above	All above Certificates	✓	P	V	V					
3.7	Packing / Marking		Major	Visual / Compare	100 %	--	Order	see column 7		-	P	-	-					

REMARKS:

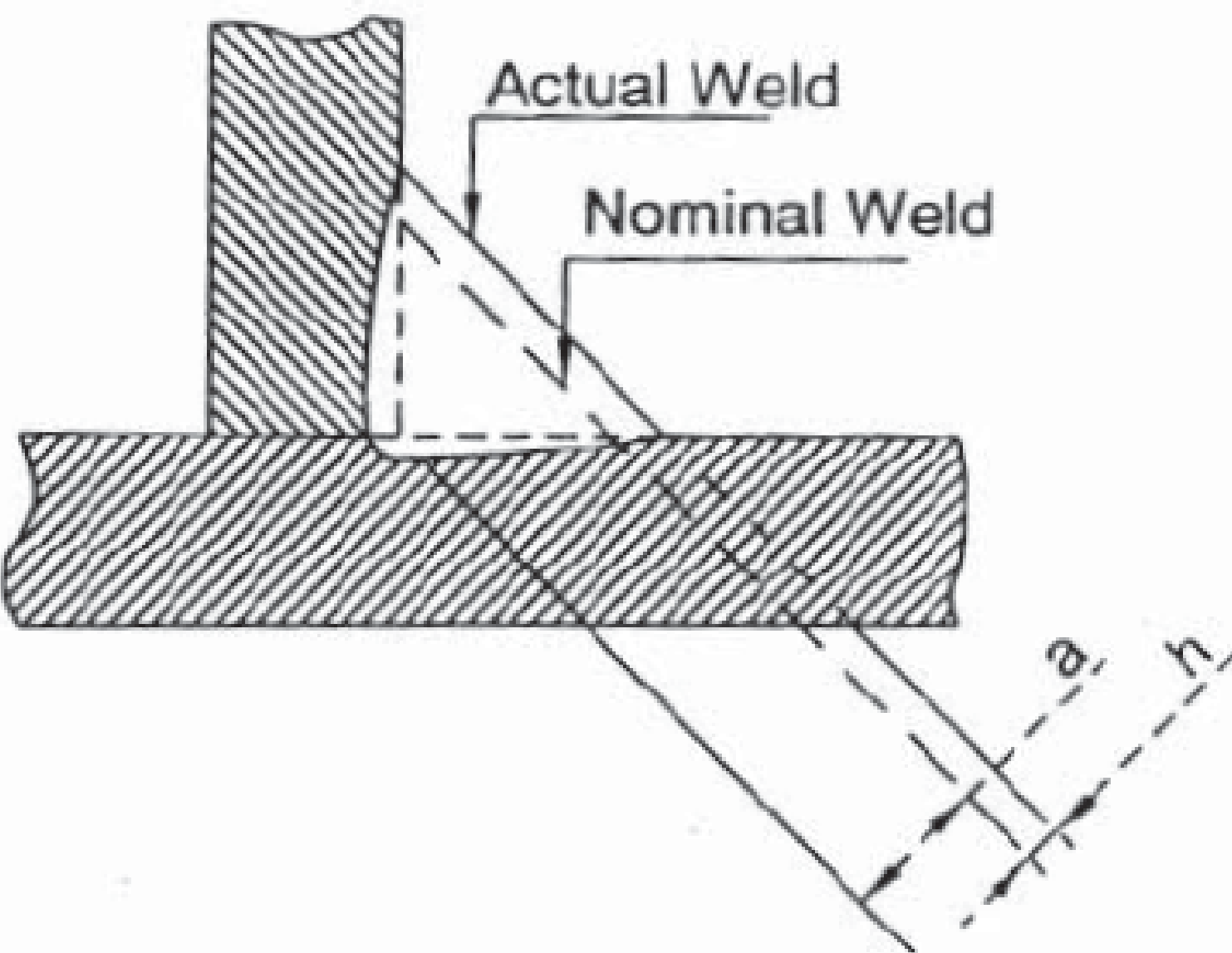
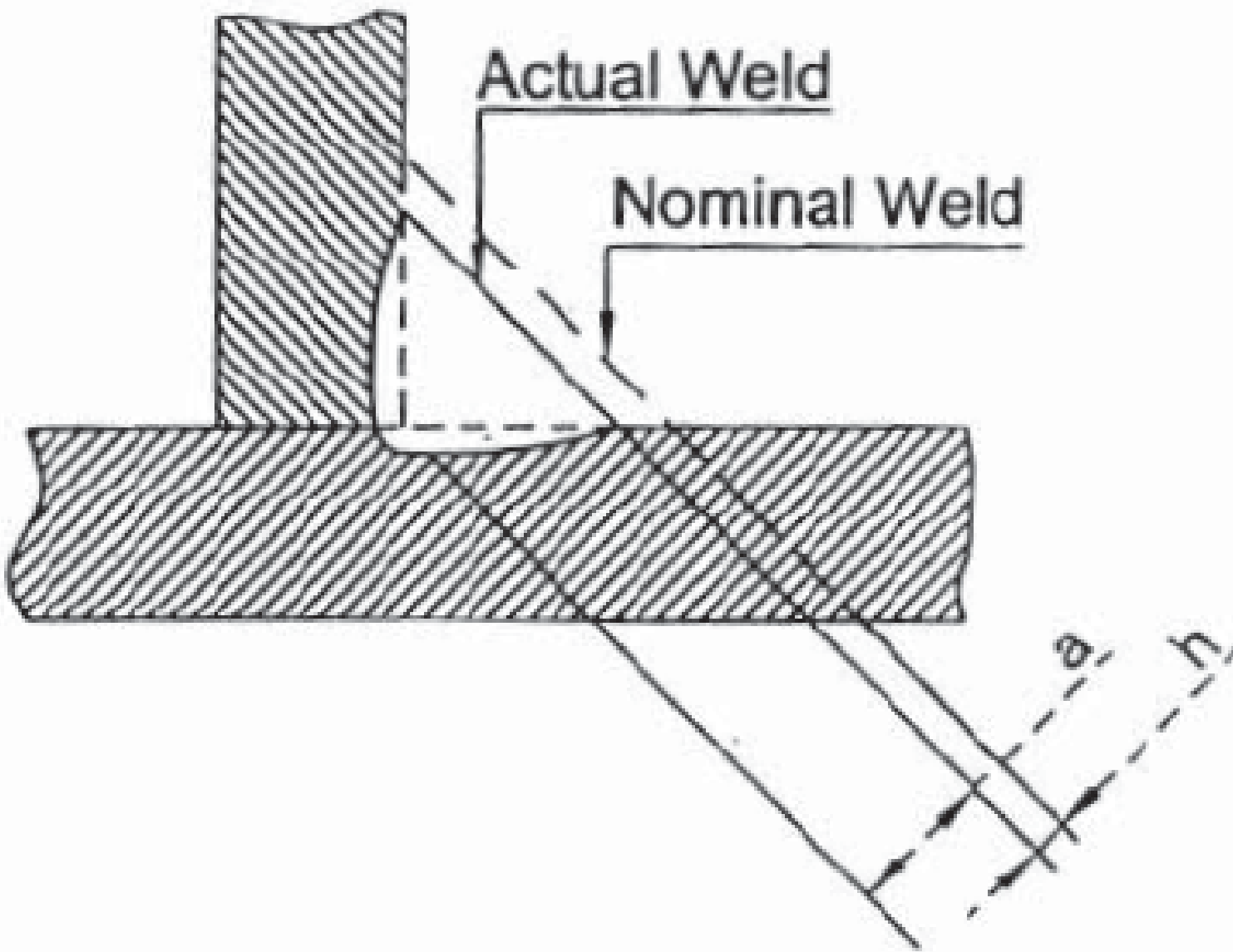
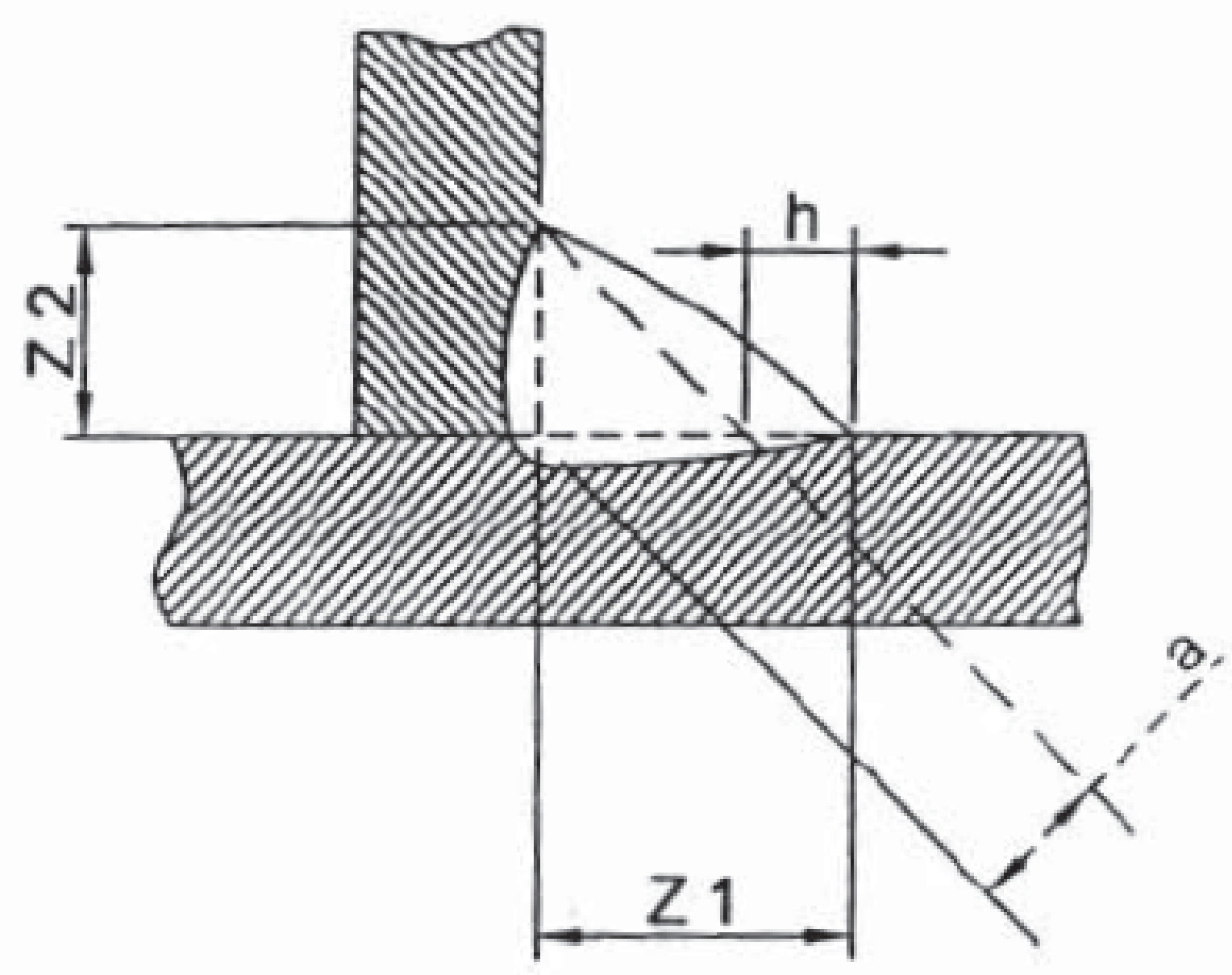
1. DIN standard (DIN 2096) for helical compression springs of the VIS.
2. Tolerances for spring constant.
3. One measurement of the horizontal spring constant for each type/size of springs in four directions (0°, 90°, 180°, 270°)

LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER , B: BHEL/ CUSTOMER, P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE,	
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ANNEXURE - 1

WELDING

WELDING DETAILS

SI No	Imperfection Designation	Outside status	Limits for Imperfection with reference to quality level: DIN EN 25817 / D
1.	Excessive convexity		$h \leq 1\text{mm} + 0.25\text{ } b \text{ ; max. } 5\text{mm}$
2.	Fillet weld having a throat thickness smaller than the nominal value	 A fillet weld with an apparent throat thickness smaller than that prescribed should not be regarded as being imperfect if the actual throat thickness with a compensating greater depth of penetration complies with the nominal value.	Short imperfections: $h \leq 0.3\text{ mm} + 0.1.a \text{ ; max. } 2\text{mm}$ Long imperfections: Not Permitted
3.	Excessive asymmetry of fillet weld	 It is assumed that the asymmetric fillet weld has not been expressly prescribed.	$h \leq 2\text{mm} + 0.2\text{ } a$

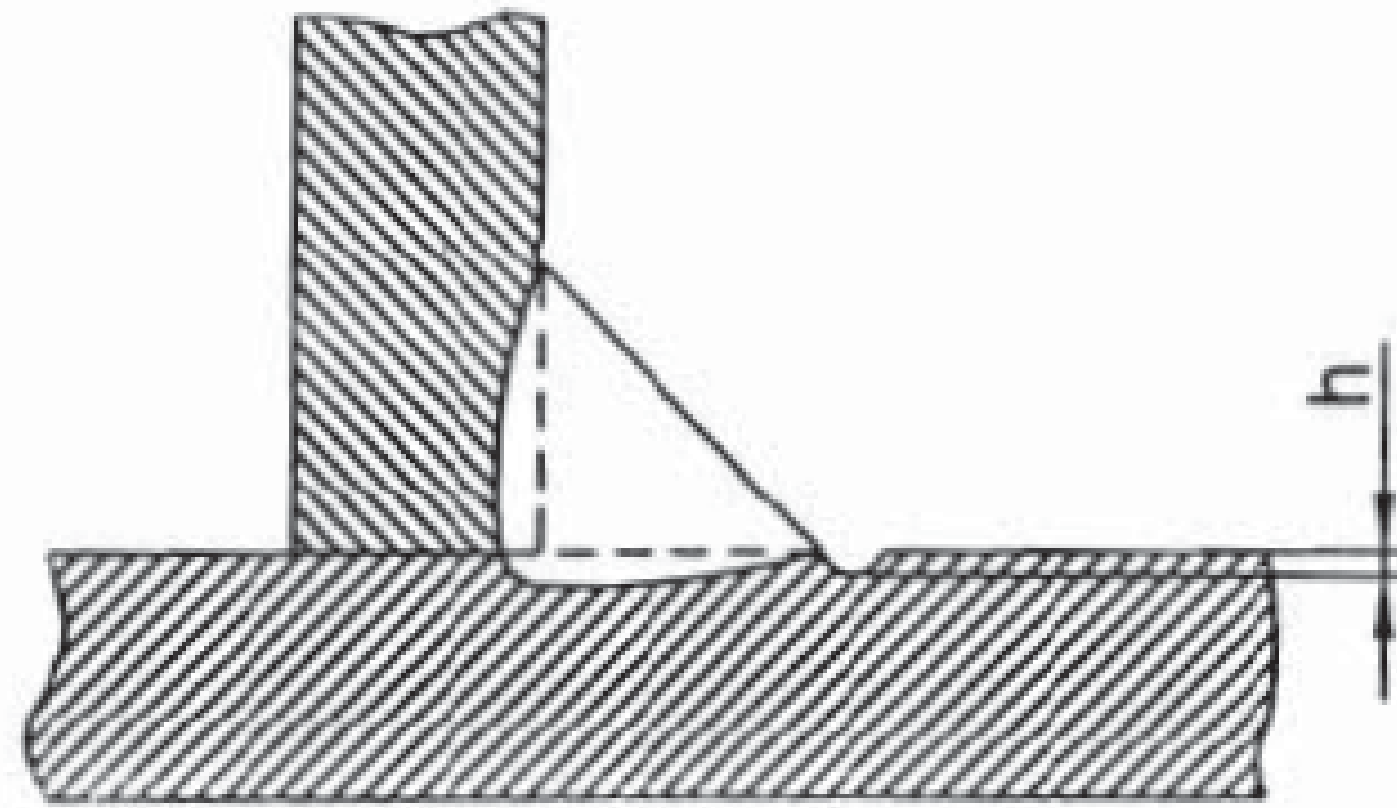
WELDING DETAILS

Limits for Imperfection with
reference to quality level:
DIN EN 25817 / D

SI
No Imperfection
Designation

Outside status

4. Undercut



Smooth transition is required

$h \leq 1.5\text{mm}$

5. Gas pores and porosity

The following conditions and limits for
imperfections shall be fulfilled

a) Maximum dimension of the summation of the
projected or surface crack area of the
imperfection.

4%

b) Maximum dimension of a single pore for
-butt welds
-fillet welds

$d \leq 0.5 s$
 $d \leq 0.5 a$

c) Maximum dimension for a single pore

5 mm

6. Localised (clustered)
porosity

The total pore area within the cluster should be
summed and calculated as a percentage of the greater
of the two areas; an envelop surrounding all the pores
or a circle with a diameter corresponding to the weld
width.

The permitted porous area should be local. The
possibility of masking other imperfections should be
taken into consideration.

The following conditions and limits for imperfections
shall be fulfilled:

a) Maximum dimension of the summation of the
projected or surface crack area of the imperfection

16%

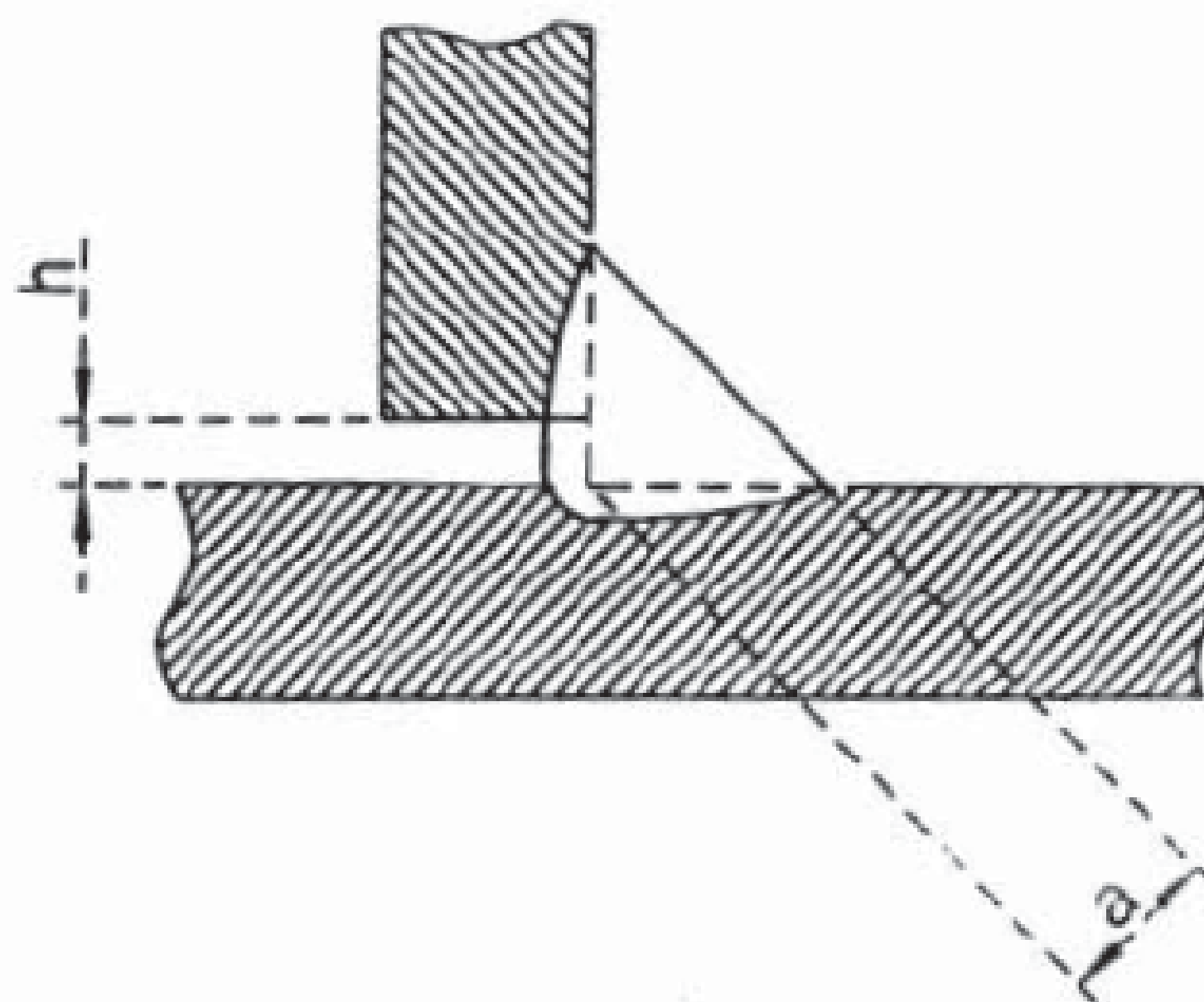
b) Maximum dimension of a single pore for
-butt weld
-fillet weld

$d \leq 0.5 s$
 $d \leq 0.5 a$

c) Maximum dimension for localised clustered porosity.

4mm

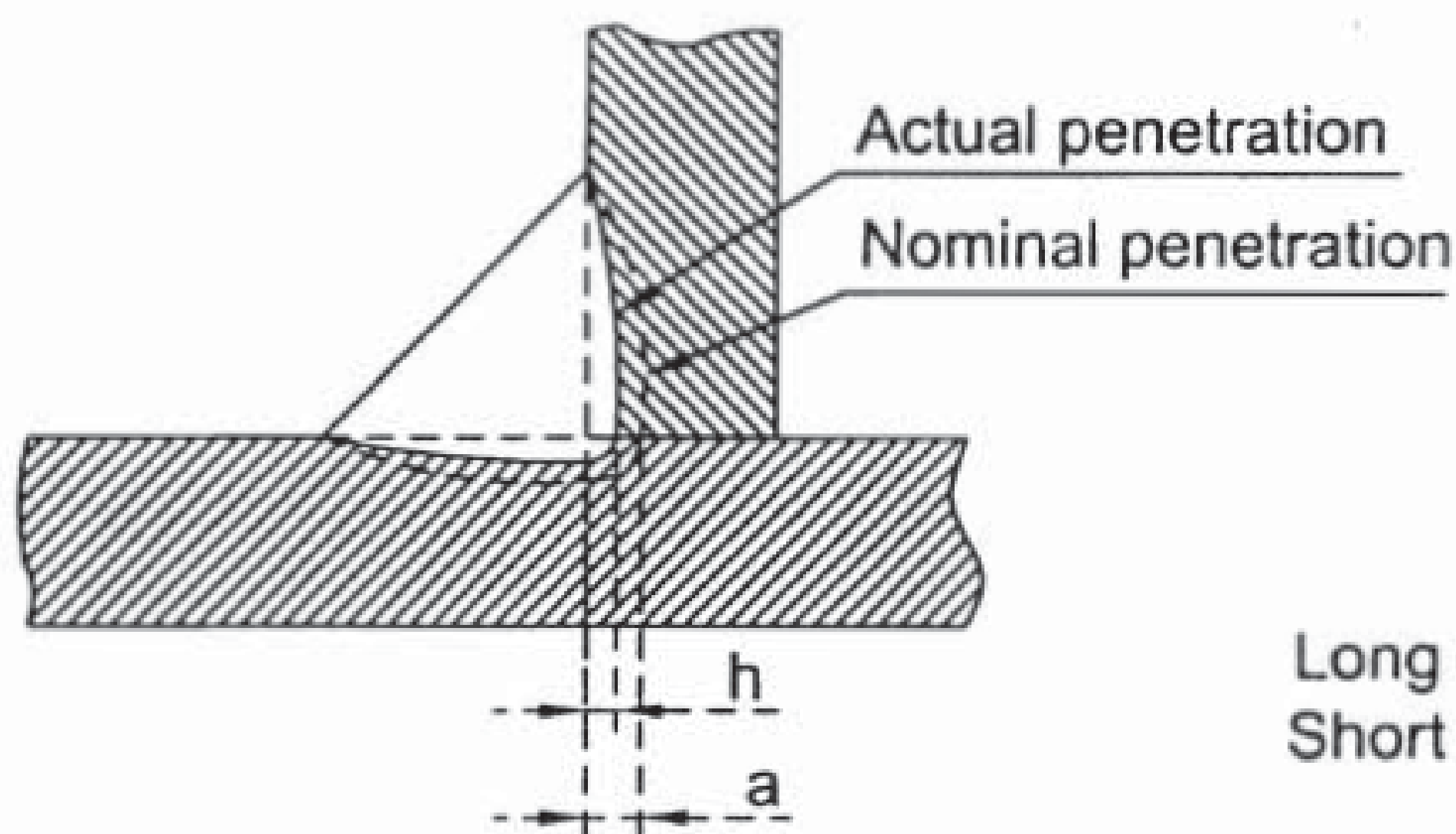
WELDING DETAILS

Sl No	Imperfection Designation	Outside status	Limits for Imperfection with reference to quality level: DIN EN 25817 / D
7.	Elongated cavities, worm holes	Long imperfections for -butt welds -fillet welds In any case, maximum dimension for elongated cavities, worm holes	$h \leq 0.5 s$ $h \leq 0.5 a$ 2mm
		Short imperfections for -butt welds -fillet welds In any case, maximum dimension for elongated cavities, worm holes	$h \leq 0.5 s$ $h \leq 0.5 a$ 4mm or Not Larger Than Thickness (NLTT)
8.	Solid inclusions (other than copper)	Long imperfections for -butt welds -fillet welds In any case, maximum dimension for elongated cavities, worm holes	$h \leq 0.5 s$ $h \leq 0.5 a$ 2mm
		Short imperfections for -butt welds -fillet welds In any case, maximum dimension for elongated cavities, worm holes	$h \leq 0.5 s$ $h \leq 0.5 a$ 4mm or Not Larger Than Thickness (NLTT)
9.	Lack of fusion (Incomplete fusion)		Permitted, but only intermittently and not breaking the surfaces
10.	Bad fit-up, fillet weld		
		An excessive or insufficient gap between the parts to be joined. Gaps exceeding the appropriate limit may in cases be compensated for by a corresponding increase in the throat.	$h \leq 1\text{mm} + 0.3 a$ max. 4mm

SI
No Imperfection
Designation

Outside status

11. Incomplete penetration



Long imperfections: Not permitted
Short imperfections: $h \leq 0.2 s$,
max. 2mm

12. Cracks

All types of cracks

Not Permitted

13. Crater cracks

Permitted

14. Spatters

Fused welding splashes are material trickless
(drops) fused to the basic material or welding
seam.

Permissible

15. Stray flash or
arc strike

Ignition points are local fuses caused by the
electric arc on the surface of the basic material
or welding seam.

Permissible

Abbreviations

- a nominal fillet weld throat thickness (fillet thickness), in mm
- b width of weld reinforcement, in mm
- d pore diameter in mm
- h size (height or width) of imperfection, in mm
- l length of imperfection, in mm
- s nominal butt weld thickness or, in the case of partial penetration, the prescribed depth of penetration, in mm
- t tube-wall- or plate thickness, in mm
- z leg length of fillet welds (in case of isoscele-right angle triangular section $z = a . / 2$) in mm

ANNEXURE-2
CORROSION PROTECTION PAINTING

REQUIREMENTS

1. Painting of steel parts

All steel parts must be coated immediately after short blasting according to EN-ISO 12944-4. Surface must be free of fat.

- a. Material:
 - M/s Southfield paints –RAL 6011 Green or equivalent
 - M/s Toyo paints – RAL 1000 Black or equivalent
 - M/s Akzo Nobal Coatings India Pvt. Ltd. – RAL 1004 Yellow colour or equivalent
- b. Execution:
 - Painting is performed as given below:
 - Layer thickness:
 - Standard:
 - One layer coating thickness of minimum 100 microns.
 - Long term protection:
 - Two layers coating to total thickness of minimum 180 microns.
- c. Mixing of paint compounds:
 - The compounds (mother paint, accelerator, thinner) must be mixed according to instructions of the paint manufacture. The mixing procedure has to be adjusted to the ambient climatic situation.
- d. Coating:
 - Coating is performed with spray gun. Baking temperature 80 °C. furnace exposing time 45 minutes.
- e. Coating thickness control:
 - Measurements to be taken at 5 random points. Acceptable thickness is 10% below specified thickness.

2. Springs

All the springs must be powder coated by “Electrostatic powder coating spray process” (EPS).

- a. Preparation:
 - Springs must be oil free
- b. Execution:
 - Electrostatic spray coating with an epoxy polyester powder. Baking temperature 190 °C +10 °C. furnace exposing time of 40 minutes.
 - Colour: Black.
- c. Coating thickness:
 - Coating thickness must be minimum of 70 microns.

Note.

1. The colour of paint is subjected to as per customer requirement.

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INVENTORY NO SIGN. AND DATE REF. DRG. NO.

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DRG. NO. 2-13100-V6155

PART NO.	QTY. IN NOS.	DESCRIPTION	SUPPLIER	REMARKS	DRAWING NO.
01	1	EMBEDMENT FOR LP CASING GUIDE BOLT	HWR	FOR GUIDING LP CASING	0-13100-V6152
02	1	EMBEDMENT FOR LP CASING GUIDE BOLT	HWR	FOR GUIDING LP CASING	0-13100-V6152
03	1	EMBEDMENT FOR LP CASING GUIDE BOLT	HWR	FOR GUIDING LP CASING	0-13100-V6152
11	8	T SECTION 100X2600	BHEL-PSM/ CIVIL CONTRACTOR	FOR SUPPORT & FIRE PROTECTION	0-13100-V6152
12	8	T SECTION 100X1400	BHEL-PSM/ CIVIL CONTRACTOR	FOR SUPPORT & FIRE PROTECTION	0-13100-V6152
13	3	FLAT 10X100X15660	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
14	4	FLAT 10X100X50000	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
15	12	FLAT 10X100X1660	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
16	3	FLAT 10X100X2660	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
17	16	FLAT 10X100X3460	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
18	6	FLAT 10X100X3560	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
19	4	FLAT 10X100X1860	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
20	4	FLAT 10X100X1400	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
21	8	FLAT 10X100X1000	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
22	5	FLAT 10X100X3860	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
23	6	FLAT 10X100X4535	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
24	8	FLAT 10X100X3575	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
25	8	FLAT 10X100X9500	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
27	8	FLAT 10X100X5450	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
29	4	FLAT 10X100X3335	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
30	4	ANGLE 100X100X50000;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152/ 154
31	1	ANGLE 100X100X14500;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152/ 154
32	8	FLAT 10X100X3755	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
33	2	FLAT 10X100X1700	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
34	3	FLAT 10X100X9400	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
36	4	ANGLE 100X100X4000 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
37	4	ANGLE 100X100X2200 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
38	2	ANGLE 100X100X4100 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
39	1	ANGLE 100X100X3200 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
40	2	ANGLE 100X100X600 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
41	1	ANGLE 100X100X1900 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
42	4	ANGLE 100X100X2400 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
43	4	ANGLE 100X100X1800 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
44	2	ANGLE 100X100X5075 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
45	2	ANGLE 100X100X4400 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
46	4	ANGLE 100X100X8550 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
47	4	ANGLE 100X100X2200 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
48	8	PLATE 400X400X20	BHEL-PSM/ CIVIL CONTRACTOR	FOR ESV & IV SUPPORT	0-13100-V6152
50	4	PLATE 220X1100X10	BHEL-PSM/ CIVIL CONTRACTOR	FOR IV SUPPORT	0-13100-V6153
51	4	FLAT 10X100X10778	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
52	2	FLAT 10X100X7000	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
53	4	T SECTION 100X4000	BHEL-PSM/ CIVIL CONTRACTOR	FOR SUPPORT & FIRE PROTECTION	0-13100-V6152
54	4	T SECTION 100X2200	BHEL-PSM/ CIVIL CONTRACTOR	FOR SUPPORT & FIRE PROTECTION	0-13100-V6152
55	4	T SECTION 100X2400	BHEL-PSM/ CIVIL CONTRACTOR	FOR SUPPORT & FIRE PROTECTION	0-13100-V6152
56	4	T SECTION 100X2650	BHEL-PSM/ CIVIL CONTRACTOR	FOR SUPPORT & FIRE PROTECTION	0-13100-V6152
57	2	T SECTION 100X3900	BHEL-PSM/ CIVIL CONTRACTOR	FOR SUPPORT & FIRE PROTECTION	0-13100-V6152
58	2	T SECTION 100X3500	BHEL-PSM/ CIVIL CONTRACTOR	FOR SUPPORT & FIRE PROTECTION	0-13100-V6152
59	1	ANGLE 100X100X14500;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
60	2	ANGLE 100X100X11650;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
61	1	PIPE Ø219.1X6.3, L=3600	BHEL-PSM/ CIVIL CONTRACTOR	FOR CABLE CONDUIT	0-13100-V6152
65	04	PLATE 10X100X1000	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
66	02	ANGLE 100X100X3335;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6153
68	1	FLAT 10X100X2100	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
70	2	FLAT 10X100X9500	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
70A	2	FLAT 10X100X1550	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
70B	2	FLAT 10X100X6300	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
72	5	FLAT 10X100X400	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
73	1	FLAT 10X100X908	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
76	5	FLAT 10X100X1560	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
78	3	FLAT 10X100X700	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
79	4	FLAT 10X100X1330	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
80	1	FLAT 10X100X11250	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
80A	2	FLAT 10X100X3500	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
80B	3	FLAT 10X100X4000	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
80C	1	FLAT 10X100X4400	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152

PART NO.	QTY. IN NOS.	DESCRIPTION	SUPPLIER	REMARKS	DRAWING NO.
86	12	FLAT 10X100X3950	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
87	3	FLAT 10X100X5000	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
88	2	FLAT 10X100X3440	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
89	2	FLAT 10X100X4300	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
91	3	FLAT 10X100X8550	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
92	4	FLAT 10X100X7245	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
93	4	FLAT 10X100X7245	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
P001P	1	PLATE 400X400X20	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
P002P	1	PLATE 400X400X20	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
P003P	1	PLATE 400X400X20	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
P004P	1	PLATE 400X400X20	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
P008P	1	PLATE 400X400X20	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
94.	10	PLATE AS PER DETAIL U OF DRG. NO. 1-13100-V6152 SH2	BHEL-PSM/ CIVIL CONTRACTOR	FOR IVSV MAINTENANCE PLATFORM SUPPORT.	0-13100-V6152
95	2	FLAT 10X100X5600	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
96	2	FLAT 10X100X1400	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
97A	2	ANGLE 100X100X1150 ;THK 10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152/ 154
97B	1	ANGLE 100X100X12200;THK10	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152/ 154
93A	1	FLAT 10X100X900	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
93B	1	FLAT 10X100X800	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
A	10	ANCHOR BOX	HWR	FOR LP FRONT AND REAR PEDESTALS	0-13100-V6152
C	8	ANCHOR BOX	HWR	FOR LP FRONT AND REAR PEDESTALS	0-13100-V6152
E	4	ANCHOR BOX	HWR	FOR IP FRONT PEDESTAL	0-13100-V6152
F1	2	ANCHOR BOX	HWR	FOR HP FRONT PEDESTAL	0-13100-V6152
F2	2	ANCHOR BOX	HWR	FOR HP FRONT PEDESTAL	0-13100-V6152
G	6	ANCHOR BOX	HWR	FOR LP FRONT AND REAR PEDESTALS	0-13100-V6152
OV	3	PLATE 1000X4000X20	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
98	2	PLATE 600X4000X20	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6154
97	1	FLAT 10X100X3200	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
98A	1	FLAT 10X100X880	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152
98B	1	FLAT 10X100X745	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR FIXING OF PIPE SUPPORTS.	0-13100-V6152

PART NO.	QTY. IN NOS.	DESCRIPTION	SUPPLIER	REMARKS	DRAWING NO.
A*	32	PIPE 168.3x7.1 L=1800	BHEL-PSM/ CIVIL CONTRACTOR	FOR ANCHOR BOLTS OF GENERATOR	013100V6152
A1*	5	PIPE 168.3x17.5 L=2290	BHEL-PSM/ CIVIL CONTRACTOR	FOR ANCHOR BOLTS OF EXCITER	013100V6154
B*	4	PIPE 141.3x6.55, L=3790	BHEL-PSM/ CIVIL CONTRACTOR	FOR ANCHOR BOLTS OF EXCITER	013100V6154
B1*	5	PIPE 141.3x6.55, L=2290	BHEL-PSM/ CIVIL CONTRACTOR	FOR EXCITER CABLES	013100V6154
C*	1	PIPE DN 88.9x5.49 L=1570	BHEL-PSM/ CIVIL CONTRACTOR	FOR EXCITER DRAIN	013100V6154
C1*	1	PIPE DN 88.9x5.49 L=2290	BHEL-PSM/ CIVIL CONTRACTOR	FOR EXCITER CABLES	013100V6154
D*	1	PIPE 406.4x7.92 L=3000	BHEL-PSM/ CIVIL CONTRACTOR	FOR PRIMARY WATER PIPES	013100V6154
E*	8	ISMB BEAM IPB 300 L=1600	BHEL-PSM/ CIVIL CONTRACTOR	FIXING POINT OF STATOR ALIGNMENT	013100V6152
F*	4	PLATE 300x300x16	BHEL-PSM/ CIVIL CONTRACTOR	FIXING POINT OF STATOR ALIGNMENT	013100V6152
G*	2	PLATE 2600x200x16	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR ERECTION OF TERMINAL BOX	013100V6152
G1*	5	PLATE 350X350 , THK=80	BHEL-PSM/ CIVIL CONTRACTOR	Hole of 168.3 mm at the center of plate.	013100V6152
H*	4	ANGLE 100x100x10,L=1500	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
J*	1	PIPE DN 323.8x6.35, L=1380	BHEL-PSM/ CIVIL CONTRACTOR	RECOMMENDED FOR ERECTION OF TERMINAL BOX	013100V6152
K*	2	ANGLE 100x100x10,L=15033	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
K1*	2	ANGLE 100x100x10,L=2080	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
L*	2	ANGLE 100x100x10,L=10598	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6152
M*	2	ANGLE 100x100x10,L=3400	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
N*	2	ANGLE 100x100x10, L=3035	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6152
P*	4	FLAT 100X10,L=1470	BHEL-PSM/ CIVIL CONTRACTOR	FOR FIXING OF ANCHOR BOLTS	013100V6154
Q*	1	ANGLE 75x75x5,L=2000	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
R*	2	ANGLE 100x100x10,L=472	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
S*	2	ANGLE 100x100x10,L=11400	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
T*	4	ANGLE 100x100x10,L=400	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
U*	2	ANGLE 100x100x10,L=2032	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
V*	2	ANGLE 100x100x10,L=640	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6152
W*	7	FLAT 10x100x540	BHEL-PSM/ CIVIL CONTRACTOR	FOR FIXING OF ANCHOR BOLTS	013100V6154
W1*	6	FLAT 10x100x400	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
W2*	1	FLAT 10x100x3900	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6152
W3*	2	FLAT 10x100x835	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
W4*	2	FLAT 10x100x3610	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
X*	2	FLAT 10x100x2891	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
X1*	2	FLAT 10x100x4923	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
X2*	2	FLAT 100x10X10000	BHEL-PSM/ CIVIL CONTRACTOR	FOR FIXING OF ANCHOR BOLTS	013100V6154
X3*	2	FLAT 10x130x1990	BHEL-PSM/ CIVIL CONTRACTOR	FOR FIXING OF ANCHOR BOLTS	013100V6154
Y*	4	FLAT 10x100x13500	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
Z1*	1	ANGLE 100x100x10,L=5020	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6154
Z2*	4	ANGLE 100x100x10,L=2891	BHEL-PSM/ CIVIL CONTRACTOR	FOR FIXING OF ANCHOR PLATES	013100V6152
Z3*	2	ANGLE 100x100x10,L=4923	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6152
Z4*	2	ANGLE 100x100x10,L=6315	BHEL-PSM/ CIVIL CONTRACTOR	FOR BETTER CIVIL WORK	013100V6152

REFERENCE DRAWINGS:-

- FOUNDATION PLAN (TOP VIEW) : 0-13100-V6152 SH1 & 2
- FOUNDATION PLAN (SECTIONS) : 0-13100-V6153
- FOUNDATION PLAN (BOTTOM VIEW) : 0-13100-V6154

NOTE:-

- WHERESOEVER MATERIAL IS NOT MENTIONED, IT MAY BE TAKEN AS STRUCTURAL STEEL OF COMMERCIAL QUALITY (IS:2062)
- MATERIAL OF PIPES IS SEAMLESS PIPE ASTM A 106 GR. B. HOWEVER, ERW PIPES CAN ALSO BE USED.

PRELIMINARY

CONSULTANT: LAHMEYER INTERNATIONAL INDIA PRIVATE LIMITED	
CUSTOMER: TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED 5th Floor, Western Wing, NPKRR Maaligai, 144, Anna Salai, Chennai-600002	
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT 1X800 MW TANGEDCO NORTH CHENNAI TPP STAGE III-BTG	
GRADE OF UNTOL.DIM M/CG.-C/M/F AAO230208 WELDING-A/B/C/P AA0621104 GAS CUTTING-T3/AA0621101	
DEPT PED CODE 4066	
TITLE : LIST OF TG DECK EMBEDMENTS	
DRAWING NO. 2-13100-V6155 SHEET No. 01 No. OF SHEETS 01	

BOTTOM VIEW

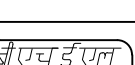
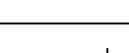
CL CONDENSER

CL CONDENSER

REFERENCE DRAWINGS:-

1. FOUNDATION PLAN (TOP VIEW) : 0-13100-V6152 SH1 & 2
2. FOUNDATION PLAN (SECTIONS) : 0-13100-V6153
3. LIST OF TG DECK EMBEDMENTS : 2-13100-V6155

PRELIMINARY

CONSULTANT:		LAHMEYER INTERNATIONAL INDIA PRIVATE LIMITED										B																	
CUSTOMER:		TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED																											
		5th Floor, Western Wing, NPKRR Maaligai, 144, Anna Salai, Chennai-600002																											
US RS	TYPE OF PRODUCT		1X800 MW TANGEDCO NORTH CHENNAI TPP																										
	OR																												
	NAME OF CUSTOMER/PROJECT		STAGE III-BTG																										
		BHARAT HEAVY ELECTRICALS LTD.		<table border="1"> <thead> <tr> <th>NAME</th> <th>SIGN.</th> <th>DATE</th> <th>NO. OF VAR</th> </tr> </thead> <tbody> <tr> <td>DRN S.FAL</td> <td>-S/-</td> <td>13.07.2016</td> <td></td> </tr> <tr> <td>CDL NILESH</td> <td>-S/-</td> <td>13.07.2016</td> <td></td> </tr> <tr> <td>APPG R.PANJA</td> <td>-S/-</td> <td>13.07.2016</td> <td></td> </tr> </tbody> </table>		NAME	SIGN.	DATE	NO. OF VAR	DRN S.FAL	-S/-	13.07.2016		CDL NILESH	-S/-	13.07.2016		APPG R.PANJA	-S/-	13.07.2016		RANIPUR, HARDWAR							
NAME	SIGN.	DATE	NO. OF VAR																										
DRN S.FAL	-S/-	13.07.2016																											
CDL NILESH	-S/-	13.07.2016																											
APPG R.PANJA	-S/-	13.07.2016																											
DEPT	PED	SCALE		WEIGHT (KG)		REF. TO ASSY. DRG.		ITEM NO.		NO. OF ITEMS																			
CODE 4066		 1:50, 1:25		—		—		—		—																			
TITLE : FOUNDATION PLAN				CARD CODE		DRAWING NO.				REV.																			
BOTTOM VIEW						0-13100-V6154				1.00																			
						SHEET NO. 01				NO. OF SHEETS 24																			

				GMS-No./		C.B.O.M		STAT OF JOB	
				APPROVED SHEET	NAME	SIGN		DATE	
GRADE OF UNTOLDIM									
M/CG.- G /M/ F AAO230208									
WELDING- A /B/ B AAO621104									
GAS CUTTING-'T3'AAO621104									
REV	DATE	ALTERED CHECKED		REV	DATE	ALTERED CHECKED			

REV	DATE	ALTERED	REV	DATE	ALTERED	REV	DATE	ALTERED
		CHECKED			CHECKED			CHECKED



SECTION X-X

REFERENCE DRAWINGS:-

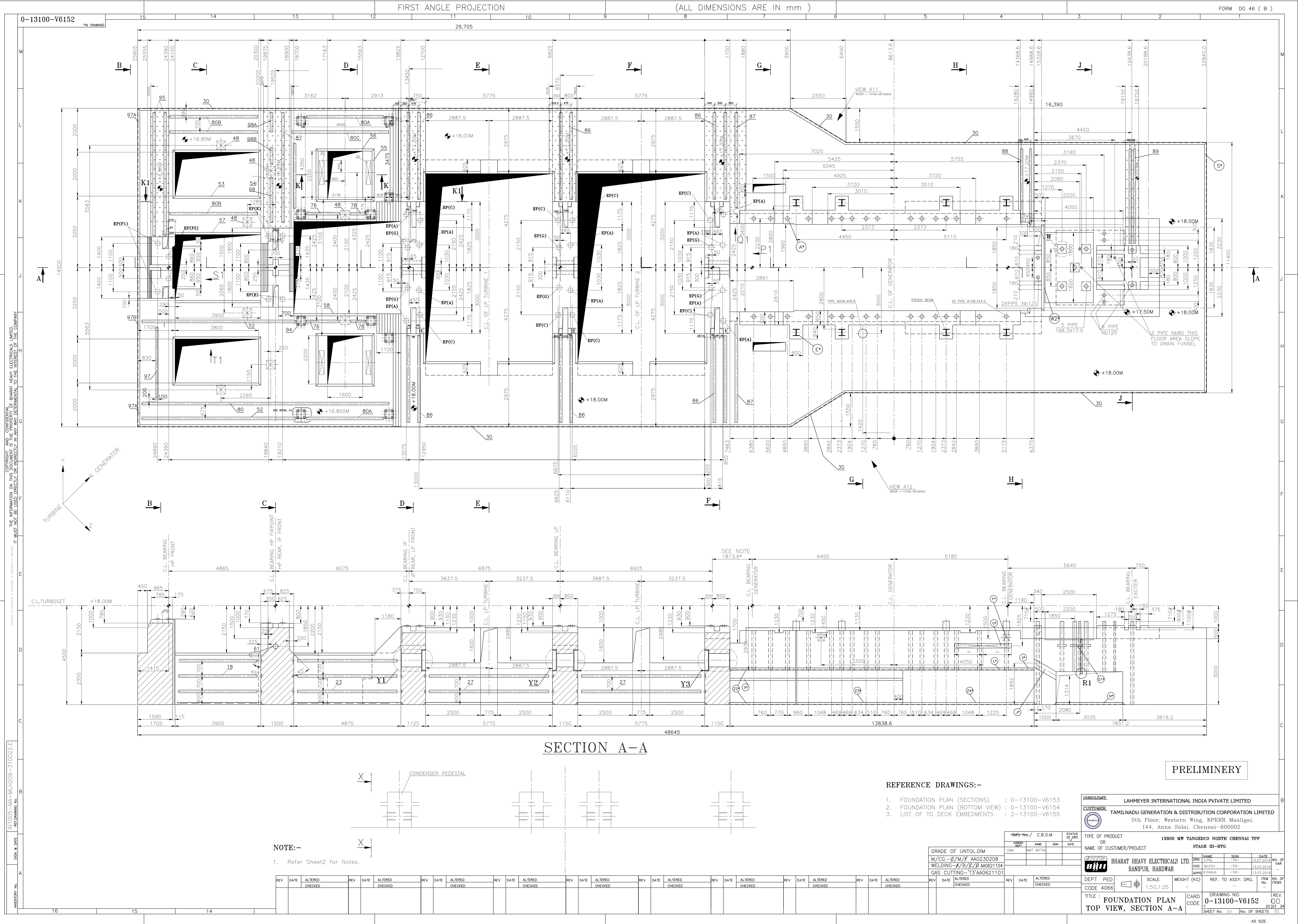
1. FOUNDATION PLAN (TOP VIEW) : 0-13100-V6152 SH1 & 2
2. FOUNDATION PLAN (BOTTOM VIEW) : 0-13100-V6154
3. LIST OF TG DECK EMBEDMENTS : 2-13100-V6155

NOTE:-

1. DIMENSIONS MARKED WITH # HAVE BEEN ADJUSTED FOR ALIGNMENT OF ROTOR TRAIN. SEE ALIGNMENT OF ROTOR TRAIN TABLE.
2. FOR EP (ANCHOR BOX) POSITIONS SEE PLAN VIEW SEE 0-13100-V6152

PRELIMINARY

				CONSULTANT LAHMEYER INTERNATIONAL INDIA PRIVATE LIMITED			
				CUSTOMER TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED 5th Floor, Western Wing, NPKRR Maaligai, 144, Anna Salai, Chennai-600002			
CBOM NO. _____ STATUS OF DRG _____ AGREEP DATE _____ NAME _____ SIGN _____ DATE _____				TYPE OF PRODUCT _____ OR NAME OF CUSTOMER / PROJECT _____			
GRADE OF UNFOL. DIM.-:- M/CG= V/C/M/F AA 0230208 WELDING-A/B/C/D-AA21104 GAS CUTTING-T3'AA0621101				1X800 MW TANGEDCO TERNULI CHENNAI TTP STAGE II-BTG			
REV. DATE ALTERED CHECKED _____ _____ _____				DEPT. PED _____ CODE 4066 _____ TITLE FOUNDATION PLAN SECTIONS			
REV. DATE ALTERED CHECKED _____ _____ _____				DRN _____ CHD _____ APP. R.PANJA _____ SCALE _____ WEIGHT (Kg.) _____ REF. TO ASSY. DRG. _____ DRAWING NO. 0-13100-V6153 SHEET NO. 1 NO. OF SHEETS 1			
5 _____ 4 _____ 3 _____				ITEM NO. _____ ITEM _____ SIZE _____			



IN1005-VA-MH209-1100222
SIGN & DATE
INVENTORY No.

THE INFORMATION ON THIS DRAWING IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED.
IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

0-13100-V6152
FIRST ANGLE PROJECTION
(ALL DIMENSIONS ARE IN mm)
FORM DC 46 (B)

SECTION A-A

NOTE:-
1. Refer Sheet2 for Notes.

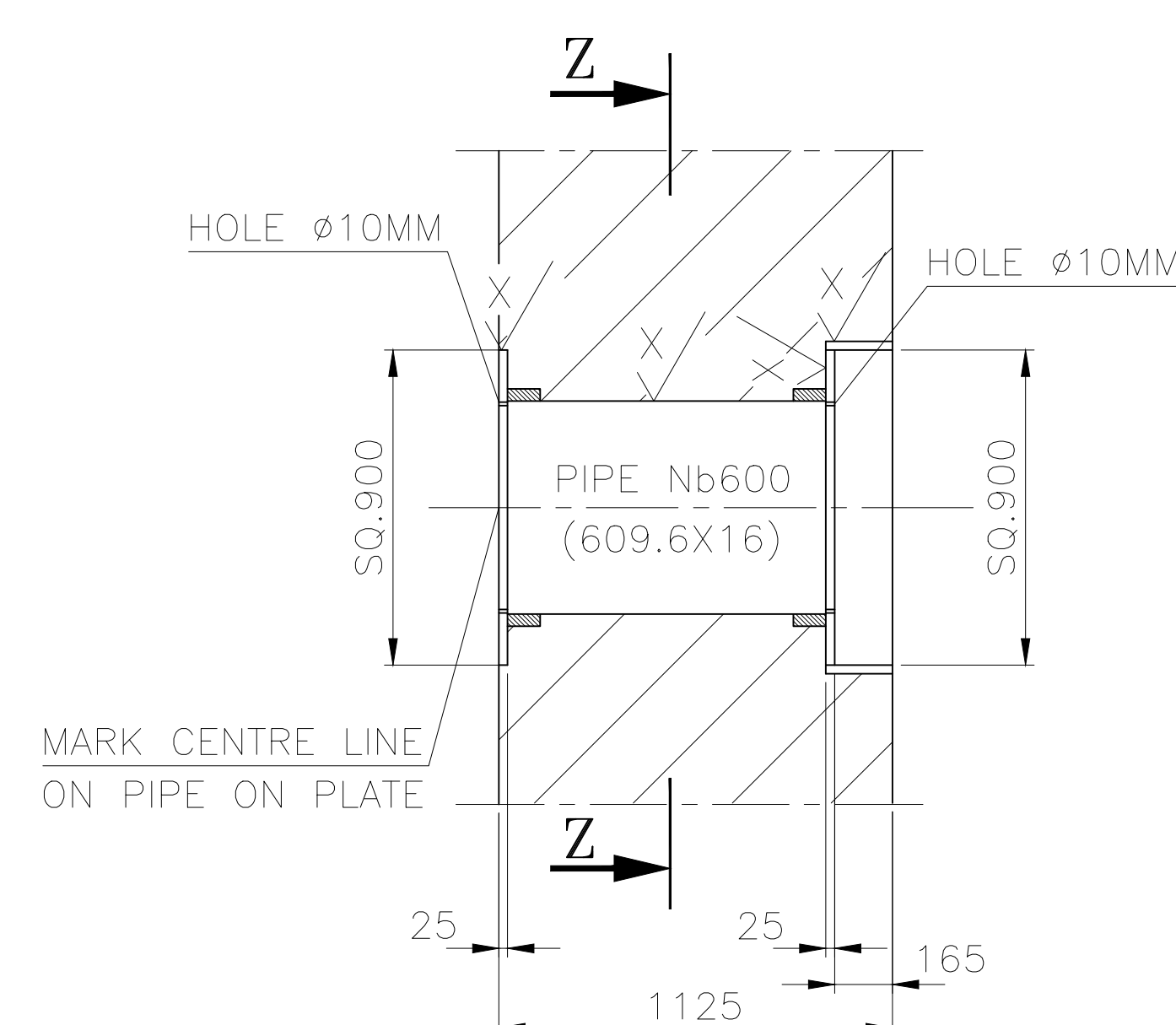
- REFERENCE DRAWINGS:-
- FOUNDATION PLAN (SECTIONS) : 0-13100-V6153
 - FOUNDATION PLAN (BOTTOM VIEW) : 0-13100-V6154
 - LIST OF TG DECK EMBEDMENTS : 2-13100-V6155

GRADE OF UNTOL.DIM M/CG - 0/M/F AA0230208 WELDING - K/B/Z/B AA0621104 GAS CUTTING - T3 AA0621101		NAME SIGN DATE		STATUS OF DRG DATE		TYPE OF PRODUCT 1X800 MW TANGEDCO NORTH CHENNAI TPP STAGE III-BTG	
NAME OF CUSTOMER/PROJECT		NAME		SIGN		DATE	
DEPT PED		SCALE		WEIGHT (KG)		REF. TO ASSY. DRG.	
CODE 4066		1:50, 1:25					
TITLE : FOUNDATION PLAN TOP VIEW, SECTION A-A		CARD CODE		DRAWING NO.		REV.	
		00		00		00	
		SHEET No. 01		No. OF SHEETS 02			

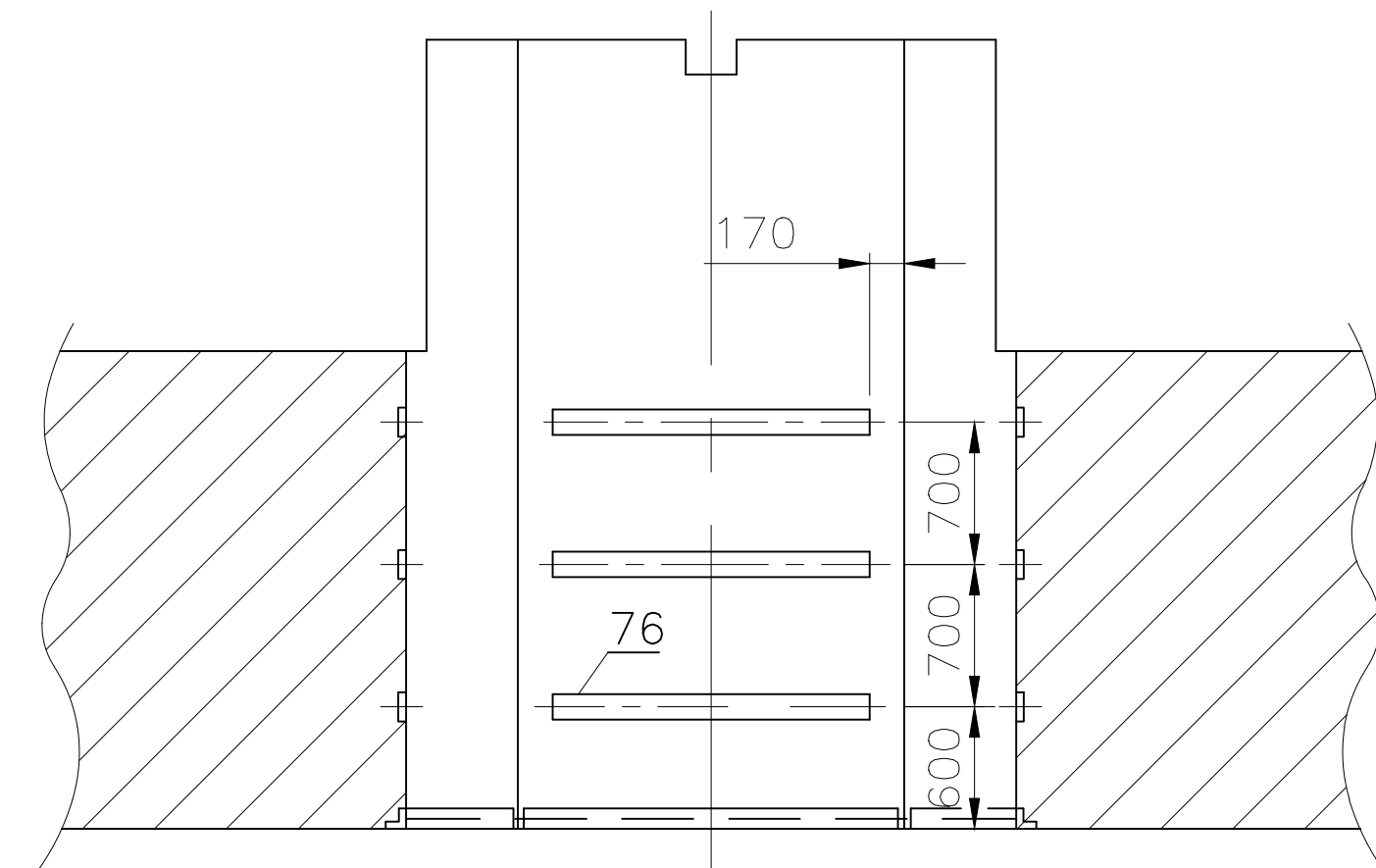
PRELIMINARY

CONSULTANT: LAHMEYER INTERNATIONAL INDIA PRIVATE LIMITED
CUSTOMER: TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
5th Floor, Western Wing, NPKRR Maaligai,
144, Anna Salai, Chennai-600002

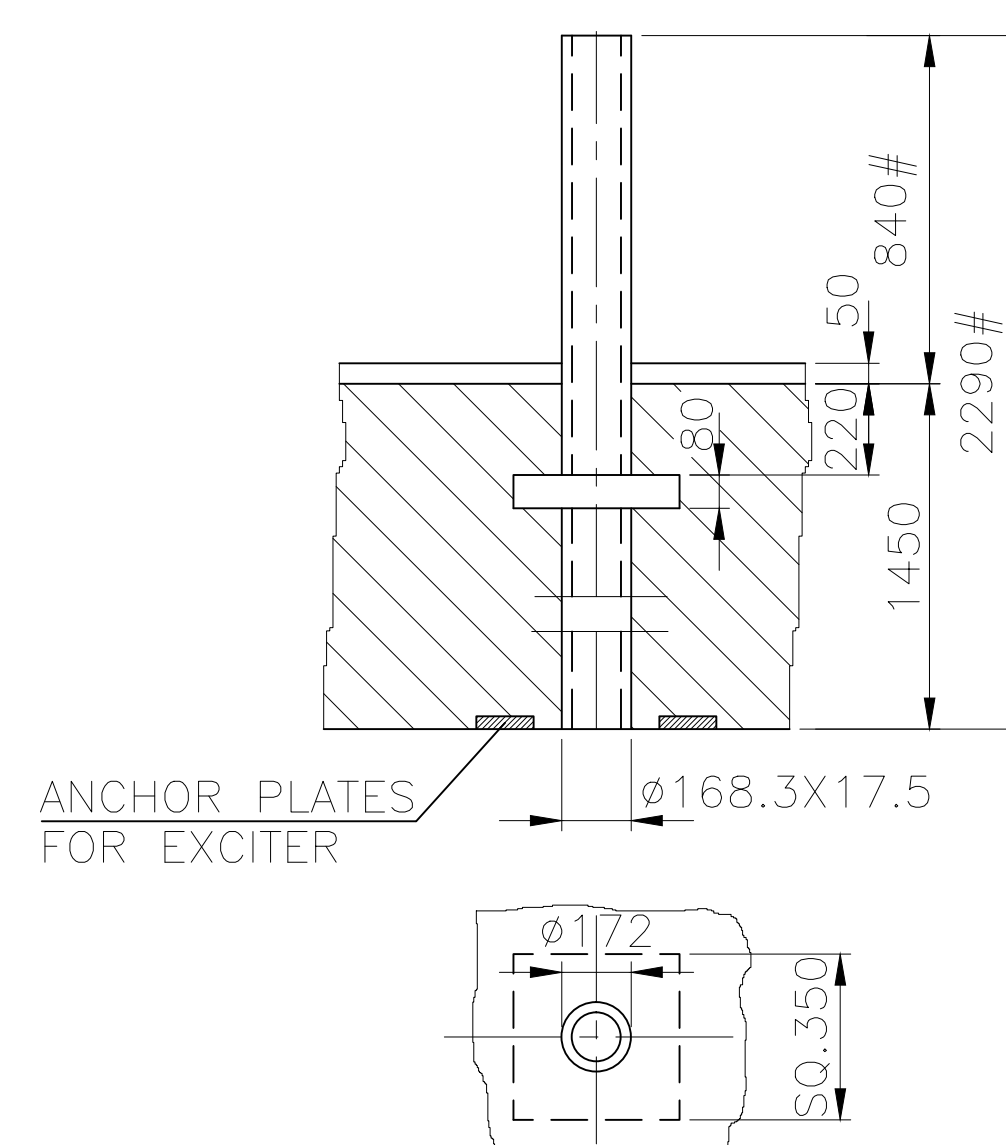
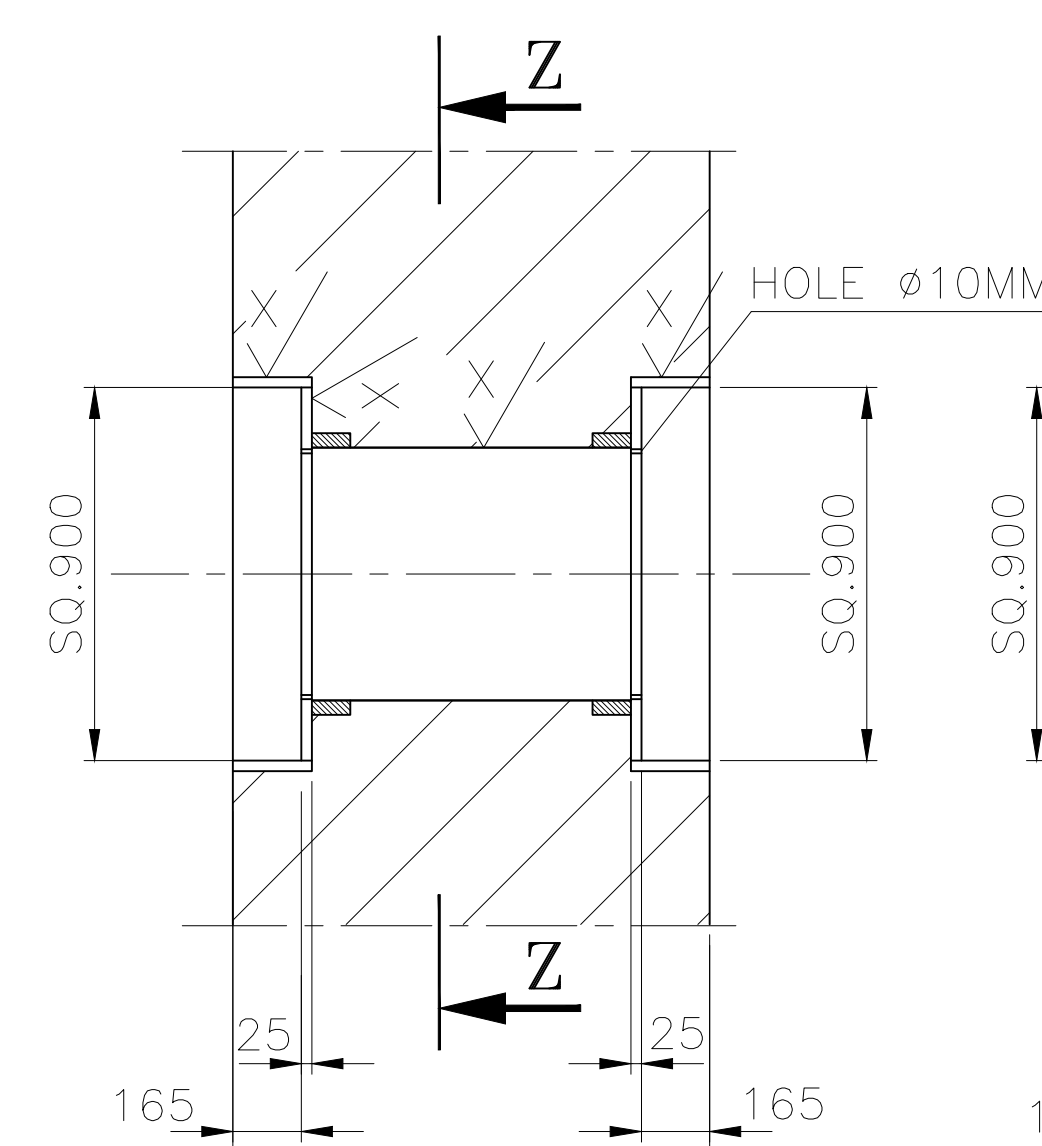
NAME	SIGN	DATE	NO. OF
BHARAT HEAVY ELECTRICALS LTD.		13.07.2016	VAR
RANIPUR, HARDWAR		13.07.2016	
		13.07.2016	



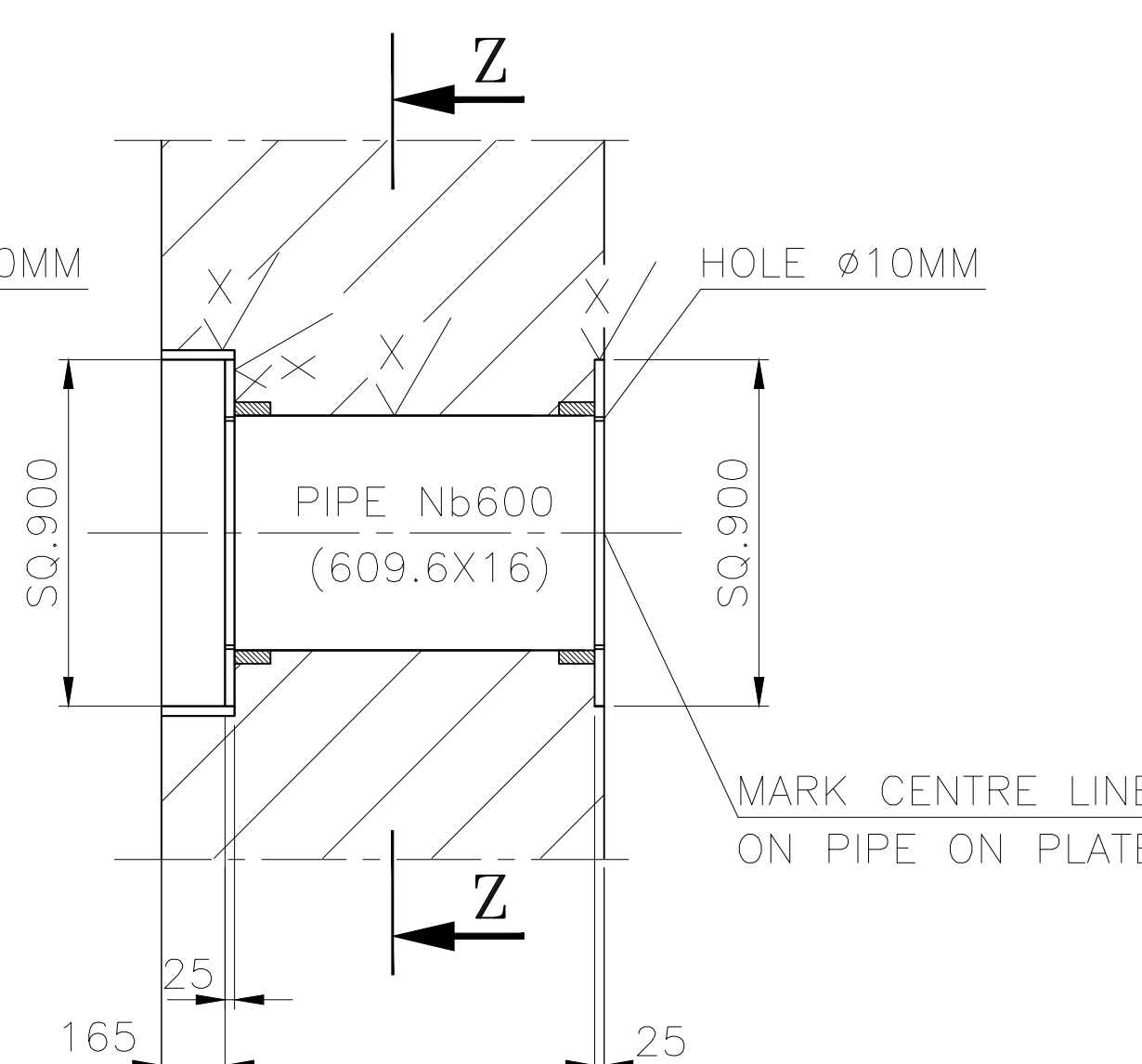
DETAIL-Y1



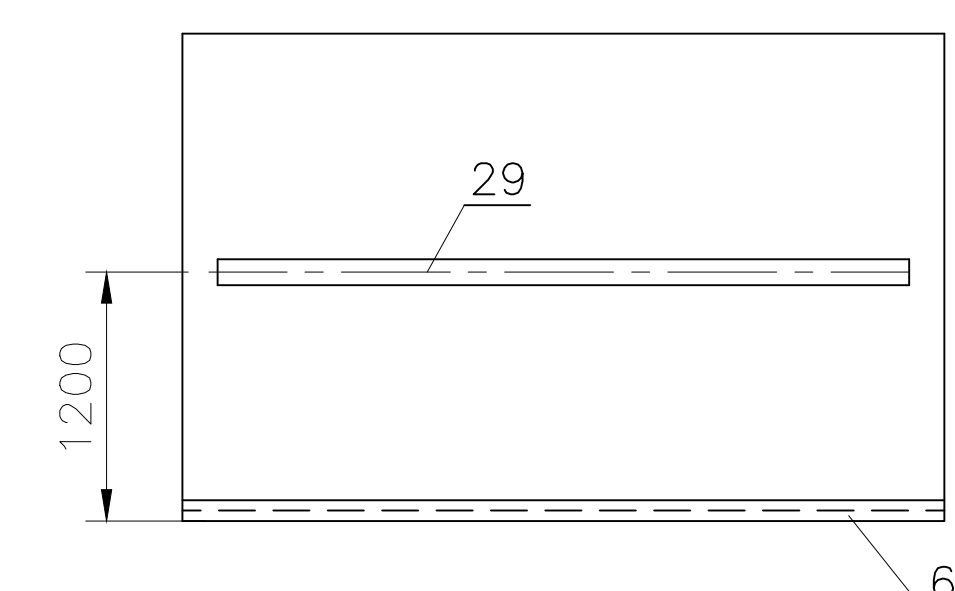
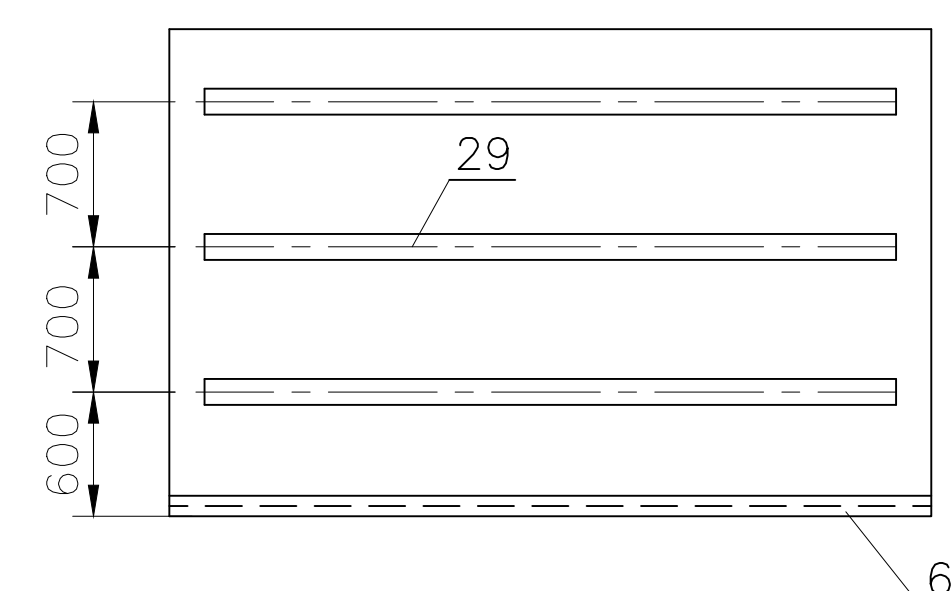
VIEW-S1

DETAIL-W

DETAIL-Y3



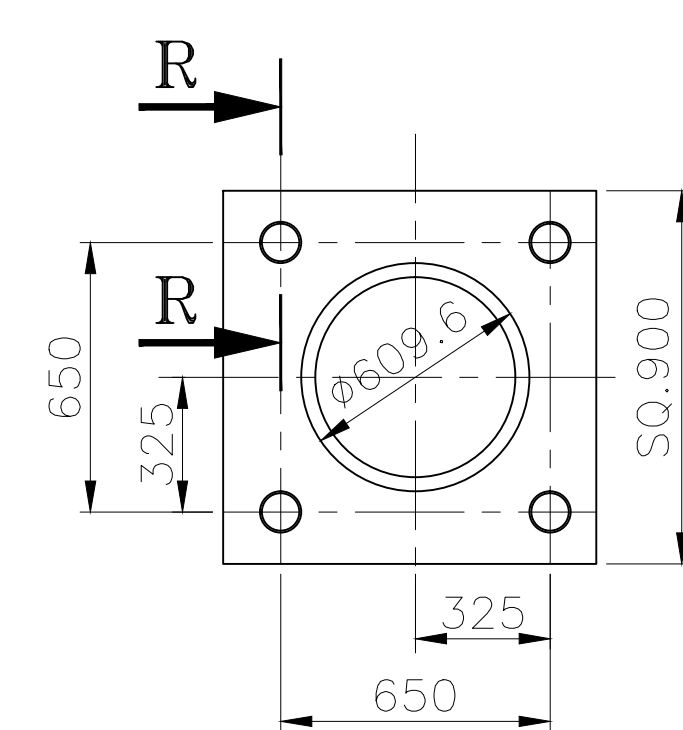
VIEW-A12



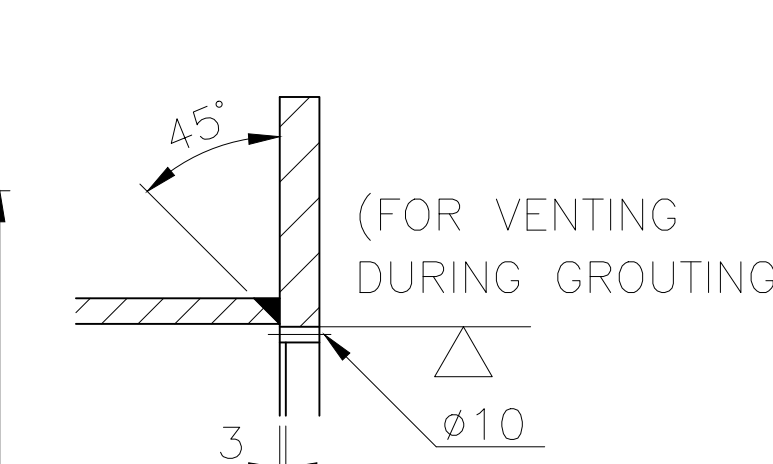
REFER NOTE-13

$\sqrt{\text{X}} = \text{WITHOUT COLOUR PAINTING} \sim \sqrt{\text{bs}} \quad (\nabla)$
 CLASSIFICATION GROUPS OF BUTT- AND FILLET WELDS IN ACC. TO ISO 5817
 QUALITY LEVEL C
 BUTT WELDS 10% ULTRASONIC
 FILLET WELDS 10% SURFACE CRACK TEST

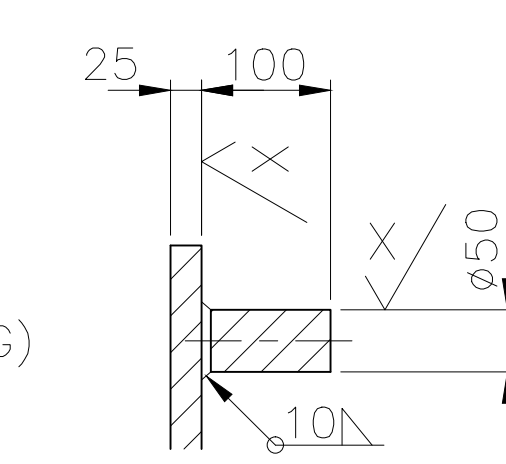
SECTION R-R



SECTION Z-Z



SECTION R-R



DATE	ALTERED	C
	CHECKED	

A1 SIZE



1. STATIC LOADS OF STATIONARY COMPONENTS.
2. STATIC LOADS FROM ROTATING PARTS.(NOT INCLUDED IN LOAD CASE 1)
3. FORCE DUE TO POWER TORQUE.
4. VACUUM LOAD DUE TO BELLOW IN LP BEARING CASING.
5. STEAM PIPING FORCES ARE ACTING THROUGH TURBINE CASINGS TO EMBEDDED FIXING POINTS IN FOUNDATION. LOADS ON FOUNDATION DUE TO PIPING MUST BE CONSIDERED AS 500KN FOR HP- AND 200KN FOR IP- TURBINE.
6. FRICTION FORCES SHOWN FOR START UP TO TURBINE AND GENERATOR. AT COOLING DOWN THE SIGNS ARE REVERSED. MAXIMUM VALUES OF REACTION FORCES TO FIXING POINTS ARE SHOWN ONLY.
7. DYNAMIC FOUNDATION LOADS DUE TO MAXIMUM PERMISSIBLE UNBALANCE ON TURBINE ROTOR.
8. LOADS DUE TO UNBALANCE FAILURE. F_r ACTS IN RADIAL DIRECTION AND CAN ASSUME ANY ANGLE BETWEEN 0° AND 360°.
9. SHORT CIRCUIT FORCES.

$$M_k = 18007 e^{-\frac{t}{0,198}} \times \sin \alpha t - 9003 e^{-\frac{t}{0,325}} \times \sin 2\alpha t + 1457 e^{-\frac{t}{0,194}} \text{ kNm}$$

$$M_k = 24119 \text{ kNm}$$

ANGULAR FREQUENCY $\omega = 314 \text{ 1/sec.}$

STATOR MOMENT OF INERTIA AROUND THE AXIS =1227Mgm²

ROTOR MOMENT OF INERTIA AROUND THE AXIS = $15,6 Mgm^2$

OPERATING SPEED = 50 1/sec.

10. VIBRATIONN LOADS DURING OPERATION ($e_{horz}=0,2g$)
11. STRETCHS ELONGATION OF FOUNDATION BOLTS IN kN.
12. ERECTION AND ALIGNMENT OF TURBINE AND GENRATOR.
M6 AND M7 BY FIRST ERECTION
M6 AND M7 BY REVISION
ONLY ONE OF THE IPB-PROFILES(LOAD POINTS M6 AND M7)PER SIDE IS
USED DURING ALIGNMENT OF THE GENRATOR AT THE SAME TIME ($\mu=0,1$)
15. ALLOWABLE LOADS AT CONNECTION POINTS DUE TO EARTHQUAKE
($e_{horz.}=0.30g$, $e_{vert.}=0.20g$)
17. TURBINE MASS (kg)

THE MENTIONED FORCES IN THE LOAD CASE 2,7,10 AND 15 FOR THE LOAD POINT W6 AND W7 WORK TO CENTRE OF BEARING AND WILL BE SUPPORTED BY 50% AT EACH FOUNDATION BEAM!

RELATED DRAWINGS:—

0-13100-U9152/ 9572-110-HWR-PVC-B-011 FOUNDATION PLAN

0-10000-58000/ 9572-110-HWR-PVM-B-002 CROSS SECTIONAL ARRANGEMENT

DESCRIPTION OF GRAPHICAL SYMBOLS:-

-  CENTER OF T.G. BEARINGS
-  VERTICAL LOAD POINT
-  ANCHOR HOLES

MODULE NO. OF DIFFERENT TURBINES:-

TURBINE	MODULE
HPT	H70-V4
IPT	I60-V2
LPT	L4X8

THE DAMPED CRITICAL NATURAL
FREQUENCIES (RPM) OF THE
TURBINE AND GENERATOR ASSEMBLY

	HP TURBINE	IP TURBINE	LP1 TURBINE	LP2 TURBINE	GENERATOR
	1 st	1 st	1 st	1 st	1 st
HORIZONTAL	1266	1123	—	971	586
VERTICAL	2097	1923	1587	1543	725

CROSSED-OUT BOXES INDICATE FREQUENCIES WHICH DON'T
CONTRIBUTE TO FOUNDATION DESIGN

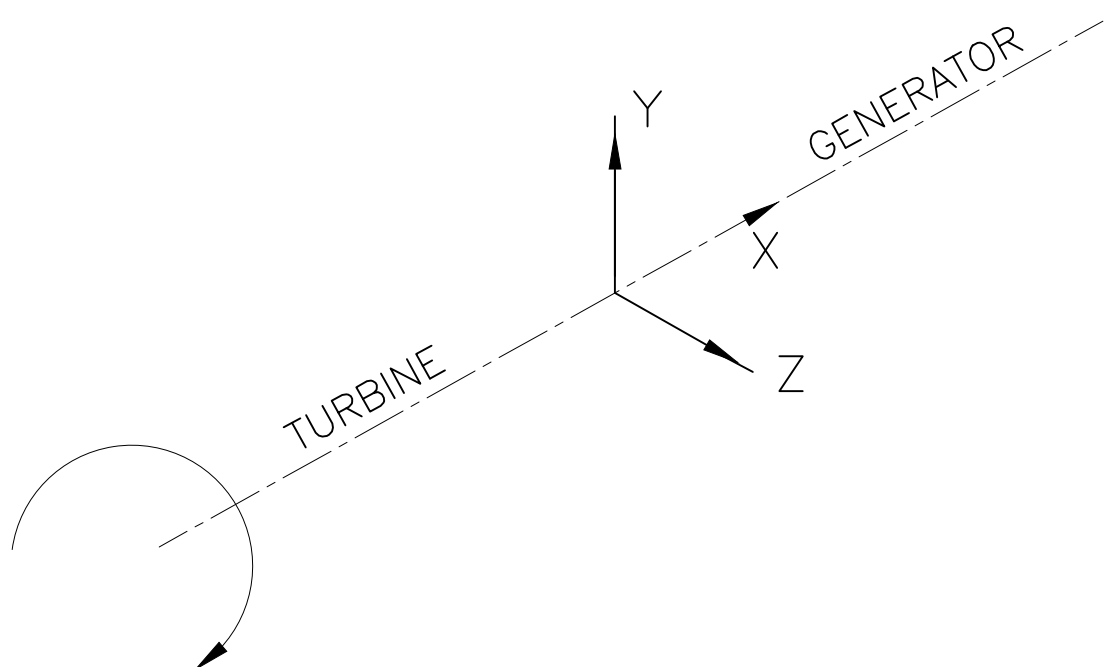
NOTES:-

A. FOLLOWING LOADS ON THE TURBOSET FOUNDATION HAVE NOT BEEN CONSIDERED.

1. LOADS OF MOUNTING EQUIPMENT, SCAFFOLDING, GANTRY CRANES, LIFTING PLATFORMS
2. LOADS DUE TO HANGERS/SUPPORTS OF MAIN PIPEWORK, ONLY GLOBAL VALUES ARE GIVEN ACCORDING TO ITEM 5 IN MAIN DESCRIPTIONS.
3. LOADS OF LARGE EQUIPMENT THAT ARE LAYED DOWN ON FOUNDATION DURING MAINTENANCE.
4. LOADS DUE TO PLATFORMS AND NOISE ENCLOSURES.
5. WEIGHT OF GROUT.

B. DIMENSINS MARKED WITH * ARE PENDING FROM SIEMENS AS ON RELEASE DATE OF THIS DRG.

DIRECTION OF ROTATION CLOCKWISE



PRELIMINARY

CONSUMLANT:												LAHMEYER INTERNATIONAL INDIA PRIVATE LIMITED											
CUSTOMER:												TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED. 5th Floor, Western Wing, NPKRR Maaligal, 144, Anna Salai, Chennai-600002											
																							
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT				1X800 MW TANGEDCO NORTH CHENNAI TPP STAGE III-BTG																			
				BHARAT HEAVY ELECTRICALS LTD. RANIPUR, HAWARD				DRP		NAME		SIGN		DATE		NO.							
				C/D		NILESH		-Sd-				13.07.2016				NO.							
				APPR		R.PANJALA		-Sd-				13.07.2016				NO.							
DEPT		PED				SCALE		WEIGHT (KG)		REF. TO ASSY. DRG.				ITEM NO.		ITEM NO.							
CODE		4066												-		-							
TITLE : LOAD ON FOUNDATION								CARD CODE		DRAWING NO. 0-13100-V6151						RE NO.							
								7		0 SHEET NO. 01 No. OF SHEETS 22						03							

FORCES AND LOADS IN kN

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IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY

PRELIMINARY

INVENTORY No.	SIGN & DATE	12565-980115-002-REV-D
		REF. DRAWING No.