

**Advanced Technology Products
High Pressure Boiler Plant**

Generic QAP for Gear Nut

CUSTOMER	Nuclear Power Corporation of India Limited (NPCIL)
PROJECT	Gorakhpur Haryana Anu Vidyut Pariyojana (GHAVP-1&2)
W.O.	D157 to D160-001-1-93-171

BHEL / Quality Assurance & Engineering			NPCIL
Prepared by: O R NITHIN <i>NK</i> 21/9/18 NITHIN K KRISHNAN	Reviewed by: S LAKSHMI <i>S. Lakshmi</i> 21/9/18	Approved by: A SUNDARARAJAN <i>A Sundararajan</i>	<i>Praveen</i> 21/9/18 CRH (upto) NPCIL

REVISIONS			
REVISION No.	DATE	DESCRIPTION	ORIGINATOR
00	21-09-2018	Initial Issue	Nithin K Krishnan

Supplier's LOGO	Supplier's Name and Address	Generic Quality Plan for Gear Nut						Project: GHAVP 1& 2 W.O : D157 to D160-001-1-93-171		
		Item: Gear Nut Material: 34Cr Ni Mo6 Sub-system: Steam Generator			QP No.: To be filled by Supplier Rev. No.: To be filled by Supplier Date: To be filled by Supplier Page No: 1 of 4					

Sl. No	Component & Operations	Characteristics	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Record		Agency			Remarks
									M	B	N	
1.	2.	3.	4.	5.	6.	7.	8.	D *	9. **			10.
1.0	Raw Material :											
1.1	Steel Melting: Method to be mentioned	Temperature	Record Verification	100%	PC-M-965 Rev-00 MPP: To be submitted		TC	√	P	R	R	---
1.2	Ladle Analysis	Chemistry	Chemical analysis	1/Heat	PC-M-965 Rev-00 MPP: To be submitted		TC	√	P	R	R	---
1.3	Ingot formation	free from defects	Visual	100%	MPP: To be submitted		RD	--	P	R	R	---
2.0	In process Controls:											
2.1	Forging to Rods/bars	Forging Process	Record Verification	100%	PC-M-965 Rev 00 MPP : To be submitted		TC	√	P	R	R	---
2.2	Heat Treatment: Annealing	R.O.H , Soaking Temp & Time, R.O.C	Review of HT Chart	100%	PC-M-965 Rev 00 HT Plan To be submitted		TC	√	P	W	R	HT chart to be submitted along with TC
2.3	Skin machining for NDE	Skin machining	Visual/Dimens ion	100%	----		RD	--	P	-	-	---
2.4	Visual Inspection of bars/rods	Free from Visual Defects	Visual Test	100%	Free from Visual Defects		RD	√	P	-	R	---
2.5	Magnetic Particle Examination (MT) of bars/rods	Surface and shallow subsurface defects	Magnetic particle test	100%	PC-M-965 Rev 00 PC-P-979 Rev 00 MT Procedure: To be submitted		TC	√	P	H	W	To be demagnetized to a residual magnetism< 2 oersted after test.

				LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: SUPPLIER B: BHEL, N: NPCIL/TPI P: PERFORM R: REVIEW W: WITNESS AND H: HOLD TC: TEST CERTIFICATE RD: RECORD HTB: HEAT TREATMENT BATCH
Prepared	Reviewed & Approved	Reviewed & Approved	Reviewed & Approved	
SUPPLIER'S NAME: To be filled		BHEL	NPCIL	

Nithin K. Krishnan
(Nithin K. Krishnan)

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(Nithin K. Krishnan)

Ramya
(R. K. Ramya) NPCIL

Supplier's LOGO		Supplier's Name and Address		Crematic Quality Plan for Gear Nut							Project: GHAVP 1& 2 W.O : D157 to D160-001-1-93-171		
				Item: Gear Nut Material: 34Cr Ni Mo6 Sub-system: Steam Generator			QP No.: To be filled by Supplier Rev. No.: To be filled by Supplier Date: To be filled by Supplier Page No:2 of 4						
2.6	Ultrasonic Inspection (UT) of rods/bars	Internal soundness	Ultrasonic Test	100%	PC-M-965 Rev 00 ASME Sec-V: SA388 UT Procedure: To be submitted	TC	√	P	H	W	---		
2.7	Identification & cutting of Test Coupons and Machining of Specimens from Test coupons	Dimensions	Measurement	100%	PC-M-965 Rev 00 MSTP : To be submitted.	RD	√	P	H	W	Refer Note-4		
2.8	Machining, threading & Gear Formation to final dimension of Gear Nut	Dimensions	Measurement	100%	PC-M-965 Rev 00 & Drawing No.: To be filled	--	--	P	-	-	---		
2.9	Heat Treatment: Quenching & Tempering (For Gear Nut and Test coupons)	R.O.H , Soaking Temp & Time, R.O.C	Review of HT Chart	100%	PC-M-965 Rev 00 HT Plan To be submitted	TC	√	P	W	R	HT chart to be submitted along with TC		
2.10	Cleaning of Gear Nut	Cleanliness	Visual	100%	PC-M-965 Rev 00 & Drawing No.: To be filled	RD	--	P	R	R	---		
2.11	Final Dimensional Check and visual examination of Gear Nut	Dimensions, Visual	Measurement, Gauge Check, Profile check	100%	PC-M-965 Rev 00 & Drawing No.: To be filled	TC	√	P	W	W	Approved gauges shall be used for checking		
3.0	Mechanical and Metallurgical Tests on Test Coupons:												
3.1	Hardness measurement	Hardness	Brinell Hardness	1/Melt/HTB	PC-M-965 Rev 00 MSTP/MPP: To be submitted	TC	√	P	W	R	Hardness survey report shall be submitted		
3.2	Product Analysis	Chemistry	Chemical analysis	1/Melt/HTB	PC-M-965 Rev-00 MPP: To be submitted	TC	√	P	R	R	--		

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Supplier's LOGO		Supplier's Name and Address		Generic Quality Plan for Gear Nut							Project: GHAVP 1& 2 W.O : D157 to D160-001-1-93-171		
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3.3	Tensile test at RT (Longitudinal)	Tensile Strength, Yield Strength (0.2% offset), % Elongation,% Reduction in area	Destructive Test	1/Melt/HTB	PC-M-965 Rev 00 MSTP/MPP: To be submitted	TC	√	P	H	W	--		
3.4	Tensile test at 350°C (Longitudinal)	Tensile Strength, Yield Strength (0.2% offset), % Elongation,% Reduction in area	Destructive Test	1/Melt/HTB	PC-M-965 Rev 00 MSTP/MPP: To be submitted	TC	√	P	H	W	--		
3.5	Impact Test at +20°C (Longitudinal)	absorbed energy, lateral expansion, % shear fracture	Destructive Test	1/Melt/HTB	PC-M-965 Rev 00 ASME SA-370 MSTP: To be submitted	TC	√	P	H	W	--		
3.6	Cone stripping Test	Proof Load Test	Destructive Test	Refer Note-5	PC-M-965 Rev 00 ASME SA-194 Cone Stripping Test Procedure: To be submitted MSTP: To be submitted	TC	√	P	W	W	--		
3.7	Micrograph for Grain size & Structure of hardest and softest bar end	Micro structure, Grain Size	Micro test, Grain size check	1/Melt/HTB	PC-M-965 Rev 00	TC	√	P	W	R	Grain size at 100X magnification and microstructure at 200X magnification on impact tested specimens at each sampling position		
4.0	Final Inspection												
4.1	Visual Inspection of Gear Nut	Free from visual defects	Verification and Visual	100%	PC-M-965 Rev 00 and as per Drg. No.: To be filled	TC	√	P	R	R	---		

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(R H Imps) NPCIL

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4.2	Marking and Identification of Gear Nut	Melt No., Manufacturer's identification, Steel grade, Inspection Agency stamp	Verification and visual	100%	PC-M-965 Rev 00	TC	√	P	R	R	All gear nuts shall be marked with identifications.		
4.3	Preservation	Appearance	Verification and Visual	100%	PC-M-965 Rev 00	TC	√	P	R	R	---		
4.4	Certification and Documentation Control	Order compliance	Certificate compilation	100%	PC-M-965 Rev 00	TC	√	P	R	R	---		
4.5	Documents (Test Certificates) shall be sent to BHEL/Trichy prior to dispatch. Dispatch clearance will be given after Acceptance of Test Certificates by BHEL&NPCIL					RD	--	P	H	H	---		
4.6	Packing & Shipment	Packing	Visual	100%	PC-M-965 Rev 00	---	--	P	-	R	Ensure Sea worthiness and right quantity of supply. Material for each unit shall be packed separately.		

- Note: 1. MSTP (Material Sampling Plan), MPP (Manufacturing Process plan), Heat Treatment Plan, Ultrasonic, Magnetic Particle etc. shall be submitted by Supplier and the same will be subjected to both BHEL&NPCIL approval.
2. Before shipment suitable rust preventive coating shall be applied to ensure sea-worthiness and tropical storage for two years.
3. MPP (Manufacturing Process plan) shall indicate detailed sequence of operations at various stages.
4. Test coupons (for representing the job) shall be identified from the forged bar/rod of adequate size to draw the specimens, if sufficient material is not available in the final forged and machined product. Size of the Test coupons and specimens shall be mentioned in MSTP (Material Sampling and Testing Plan).
5. One cone stripping test shall be performed if any visible surface discontinuities become a matter of issue.

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