



NUCLEAR POWER CORPORATION OF INDIA LTD.,
(A Government of India Enterprise)

SPECIFICATION NO. : PC – M – 965

REVISION NO. :

0							
Dec, 2013							
12							

DATE OF ISSUE
(MONTH/YEAR)

TOTAL NO. OF PAGES
(Including Cover Sheet)

TECHNICAL SPECIFICATION

FOR

FASTENERS OF FERRITIC STEELS

REF. USI NO. : 33111

	NAME	Designation	SIGNATURE	DATE
PREPARED BY	Ajit K Shit	Sr EE	<i>Ajit</i>	11/12/13
	R.K.Gupta	ACE	<i>R.K.Gupta</i>	12/12/13
	Braham Prakash	ACE	<i>Braham Prakash</i>	12/12/13
CHECKED BY	P.B.Rshikesan	ACE	<i>PBR</i>	12/12/13
	D.Ganesh	ACE	<i>D.Ganesh</i>	12/12/13
	M.R.S.Saxena	ACE	<i>M.R.S.Saxena</i>	13/12/13
REVIEWED BY	S.N.Kamath	CE	<i>S.N.Kamath</i>	19.12.13
	M.K.Sharma	CE	<i>M.K.Sharma</i>	20.12.13
APPROVED BY	U.C.Muktibodh	ED (Engg.)	<i>U.C.Muktibodh</i>	20.12.13

(For Revisions see Revision Control Sheet)

File Name :

CD No.:

(i)

REVISION CONTROL SHEET

DOCUMENT TYPE : TECHNICAL SPECIFICATION

NO. : PC - M - 965

TITLE : FASTENERS OF FERRITIC STEELS

REV. NO. & DATE	DESCRIPTION OF REVISION	PREPARED BY	CHECKED BY	REVIEWED BY	APPROVED BY
0 Dec., 2013	Original (Pages : 12)	Ajit K Shit R.K.Gupta Braham Prakash	P.B.Rshikesan D.Ganesh M.R.S.Saxena	S.N.Kamath M.K.Sharma	U.C. Muktibodh

NPCIL PROPRIETARY

This document contains confidential and protected information and that the same are the intellectual property of Nuclear Power Corporation of India Limited.(NPCIL). No part of this document including notably any editorial elements, verbal and figurative marks and images included herein, shall be reproduced or transmitted or utilized or published or stored in any form or by any means now known or hereinafter invented, electronic, digital or mechanical, including photocopying, scanning, recording or by any information storage or retrieval system, without prior written permission from NPCIL, by any person or entity. Unauthorized use, disclosure or copying is strictly prohibited and may constitute unlawful act and can attract legal action.

This page has been kept intentionally blank

	NUCLEAR POWER CORPORATION OF INDIA LTD	
	ATOMIC POWER PROJECT	Page No. : 1 of 8
	<u>TECHNICAL SPECIFICATION FOR</u> <u>FASTENERS OF FERRITIC STEELS</u>	Rev. No. : 0

1.0 SCOPE

This specification covers the technical requirements for fasteners which include studs, bolts, nuts and washers made of ferritic steels according to TRD 106, AD Markblatt W7, DIN EN 10269 Vd-TuV-Werkstoffblatt 137 and SE – Werkstoffblatt 550-57 ; unless otherwise specified. In case of doubt, more stringent of the requirements shall apply.

The specification is also applicable to the raw materials like rounds and sections used for the manufacture of the above products.

However, acceptance tests shall be conducted on the heat treated (Quenched and Tempered) samples.

This specification is applicable for Steam Generators of projects beyond RAPP-7&8.

2.0 CONTENTS

The requirements of this specification are presented under the following section headings:

Description	Section
Scope	1.0
Contents	2.0
Chemical Analysis	3.0
Heat Treatment	4.0
Minimum Mechanical Requirements	5.0
Test Specimen Location and Orientation	6.0
Tests	7.0
Non Destructive Examination	8.0
Dimensional Check	9.0
Repairs	10.0

 एनपीसीआईएल NPCIL	NUCLEAR POWER CORPORATION OF INDIA LTD	
	ATOMIC POWER PROJECT	
	<u>TECHNICAL SPECIFICATION FOR</u> <u>FASTENERS OF FERRITIC STEELS</u>	Page No. : 2 of 8 Rev. No. : 0

Procedures and Plans	11.0
Quality Surveillance	12.0
Marking and Identification	13.0
Reports	14.0
Packing and Shipment	15.0

3.0 **CHEMICAL ANALYSIS**

Both product and ladle analysis for each heat shall be done.

The chemical composition of various materials shall comply with the respective provisions of DIN EN 10269 , VdTUV- Werkstoffblatt 137 (8.62) and 337 (latest edition).

4.0 **HEAT TREATMENT**

The fasteners shall be supplied in tempered condition.

5.0 **MINIMUM MECHANICAL REQUIREMENTS**

All the mechanical requirements stipulated herein are minimum requirements and apply to condition after final heat treatment.

Materials shall comply to DIN EN 10269.

Material 20 Ni Cr Mo 14.5 II (Material No.1.6772) shall comply with the requirements laid down in VdTUV-Werkstoffblatt 337 (Latest Edition).

For material 34 Cr Ni Mo 6 (Material No.1.6582) the following minimum mechanical requirements shall be met.

	Room Temp.	350°C
Ultimate tensile strength N/ mm ²	930-1127	735
Yield point (Yp 0.2) N/ mm ²	833	559
% elongation	16	See note.
% reduction in area	45	45

 एनपीसीआईएल NPCIL	NUCLEAR POWER CORPORATION OF INDIA LTD	
	ATOMIC POWER PROJECT	Page No. : 3 of 8
	TECHNICAL SPECIFICATION FOR FASTENERS OF FERRITIC STEELS	Rev. No. : 0

Note: Although UTS & % elongation at 350°C are not specified, the supplier shall report the actual values obtained during testing in the certificate.

Material 24 Cr Mo5 shall meet all the requirements of DIN EN 10269 latest edition.

Notch Toughness

Axial ISO-V test specimens tested at 20°C shall meet the following:

Lowest individual value = 63 J

Lateral expansion = 0.65 mm minimum

All mechanical tests shall be carried out in accordance with relevant German Standards or equivalent ASTM Standards, unless otherwise specified.

6.0 TEST SPECIMEN LOCATION AND ORIENTATION

6.1 Test specimens shall have their axes in the direction of longitudinal axis of the bar.

For impact specimen, the axis of the notch will be normal to the cylindrical surface.

6.2 For bars of lengths 4 meters and above (in the tempered condition), testing shall be carried out at both ends.

6.3 Sampling depth shall be at least D/2 in axial direction, D/6 in radial from the external tempered surface for studs and bolts and 0.5 S in the case of washers and nuts.

Where, S = Wall thickness and)
D = diameter of bar) at the time of final heat treatment
as per DIN EN 10269)

Test specimen removal and all tests shall be carried out after final tempering treatment.

 एनपीसीआईएल NPCIL	NUCLEAR POWER CORPORATION OF INDIA LTD	
	ATOMIC POWER PROJECT	Page No. : 4 of 8
	<u>TECHNICAL SPECIFICATION FOR</u> <u>FASTENERS OF FERRITIC STEELS</u>	Rev. No. : 0

7.0 **TESTS**

7.1 Test shall be conducted in accordance with DIN EN 10269.
Test coupons shall be taken from the hardest and softest bars from each melt / heat treatment batch.

7.2 **Product Analysis**

Specimens for product analysis shall be taken from both the ends of each bar.

7.3 **Hardness Test**

Hardness test shall be carried out on both the ends of each bar.

7.4 **Microstructure Examination**

7.4.1 Grain size shall be determined at x 100 magnification on impact tested specimen at each sampling position.

7.4.2 Microstructure shall be examined at x 200 magnification on impact tested specimens at each sampling position.

7.5 **Tensile Test**

At each sampling position two tensile test specimens shall be taken for tests at room temperature and at + 350°C.

7.6 **Impact Test**

At each sampling position one set of three impact specimens shall be taken for test at + 20°C. The % shear fracture shall be reported for each impact test specimen. Lateral expansion shall be measured on each impact test specimen in accordance with ASME SA-370 and shall be reported.

7.7 **Cone Stripping Test**

Nuts shall be subjected to cone stripping test as per SA 194 of ASME Section II Part. A.

	NUCLEAR POWER CORPORATION OF INDIA LTD	
	ATOMIC POWER PROJECT	Page No. : 5 of 8
	<u>TECHNICAL SPECIFICATION FOR</u> <u>FASTENERS OF FERRITIC STEELS</u>	Rev. No. : 0

8.0 NON DESTRUCTIVE EXAMINATION

8.1 Ultrasonic Examination

Non destructive examination shall be carried out on bars after final heat treatment and machining but before thread rolling in accordance with SA-388, recommended practice for ultrasonic examination of heavy steel forgings.

Examination of forged bars must be performed from both frontal faces and from the cylindrical surface with normal beam probes.

If evaluation by normal beam probes on the frontal faces are not feasible, the bars shall be examined from the cylindrical surface in to and fro directions by angle beam.

For bars larger than 120 mm in diameter, additional scanning in the circumferential directions (clockwise and counterclockwise) with 35 degree angle beam probes shall be carried out.

The acceptance standards for ultrasonic examination for bars shall be as follows:

Local Indications

- D < 60 mm, CRR – 2 mm.
- D > 60 mm, CRR – 3 mm.
- D > 120 mm, CRR – 4 mm.

Where, CRR = circular reference reflector.

Indications with linear character are not acceptable. Also accumulation of defect indications in close vicinity is not acceptable.

8.2 Magnetic Particle Examination

Each bar after heat treatment and final machining but before thread cutting shall be examined by magnetic particle method (MT) in accordance with PC-P-979. The extent of examination shall be 100%. Demagnetization to a residual magnetism < 2 oersted is required after test. Any linear non axial indications shall be considered unacceptable.

 एनपीसीआईएल NPCIL	NUCLEAR POWER CORPORATION OF INDIA LTD	
	ATOMIC POWER PROJECT	Page No. : 6 of 8
	<u>TECHNICAL SPECIFICATION FOR</u> <u>FASTENERS OF FERRITIC STEELS</u>	Rev. No. : 0

9.0 **DIMENSIONAL CHECK**

The finished fasteners shall be checked for all dimensions and thread profile, pitch, etc., with the help of thread guage. All measurements shall be recorded.

10.0 **REPAIRS**

No repairs are permitted. All non conformities shall be reported to the purchaser or authorized inspection agency before carrying out remedial measures, if any.

11.0 **PROCEDURES AND PLANS**

The following procedures and plans shall be submitted to the purchaser for review and approval in six copies each before start of manufacture.

- a) Manufacturing plan indicating the sequence of operations and testing, witness and hold points.

Witness point signifies that the manufacturer will intimate date of actual performance of that activity to the Purchaser sufficiently in advance so that purchaser can witness the performance of the activity. However, in case purchaser is not present, the manufacturer can proceed with the job.

Hold point is similar to witness point except that in case of hold point the manufacturer cannot proceed with the activity unless purchaser is present or has given written waiver to proceed without his presence.

- b) Heat treatment plan.
- c) Material testing and sampling plan with sketches showing various specimens.
- d) Mechanical test properties.
- e) Non destructive examination procedure.
- f) Quality Assurance Plan.

 एनपीसीआईएल NPCIL	NUCLEAR POWER CORPORATION OF INDIA LTD	
	ATOMIC POWER PROJECT	Page No. : 7 of 8
	<u>TECHNICAL SPECIFICATION FOR</u> <u>FASTENERS OF FERRITIC STEELS</u>	Rev. No. : 0

12.0 **QUALITY SURVEILLANCE**

The fasteners shall be subjected to quality surveillance by the purchaser or his authorized inspection agency during manufacture.

A schedule for sampling and testing shall be submitted to the purchaser for review and approval. The test specimens shall be taken only after they are identified and stamped by purchaser or his authorized inspection agency.

The purchaser or his authorized inspection agency shall witness the tests at various stages. These stages shall be clearly identified in the manufacturing plan to be submitted by the supplier.

The manufacturer shall afford the purchaser or his authorized inspection agency all reasonable facilities to satisfy him that the material is being manufactured in accordance with the specification.

13.0 **MARKING AND IDENTIFICATION**

All the fasteners shall be marked with the following identifications.

- Melt No.
- Manufacturer's identification.
- Steel grade.
- Inspection agency's stamp.

14.0 **REPORTS**

Four (4) copies of the following reports shall be submitted to the purchaser immediately after completion of tests / inspection, prior to shipment of the material. The reports shall be submitted in bound volume. One set of test reports/ certificates shall be dispatched along with material for each unit.

- Chemical analysis – Ladle and product.
- Mechanical test report.

 एनपीसीआईएल NPCIL	NUCLEAR POWER CORPORATION OF INDIA LTD	
	ATOMIC POWER PROJECT	Page No. : 8 of 8
	<u>TECHNICAL SPECIFICATION FOR</u> <u>FASTENERS OF FERRITIC STEELS</u>	Rev. No. : 0

- c) CV impact curve.
- d) Non destructive examination report.
- e) Heat treatment charts.
- f) Visual and dimensional inspection report.
- g) Grain size report with micrographs for microstructure.
- h) Hardness survey report.
- i) Sulfur prints.

Final documentation containing all the above shall also be submitted in soft form (pdf format) with proper indexing.

15.0 **PACKING AND SHIPMENT**

Before shipment, suitable easily removable rust preventive coating shall be applied to ensure sea – worthiness. The fasteners shall be suitably crated to prevent the threaded surfaces from coming in contact with any foreign objects.

Material for each unit shall be packed separately.