

**Annexure –A**  
**(Tube Sizes List)**

<b>S.No</b>	<b>Material code</b>	<b>Tube Description</b>	<b>Qty (M)</b>	<b>Weight(M T)</b>
1	152030190001	TUBE OD44.45 X 5 X 10000 -UNS7740	32,860	174.32
2	152030200001	TUBE OD44.45 X 6.1 X 10000 - UNS7740	49,550	311.02
3	152030210001	TUBE OD44.45 X 8.1 X 10000 -UNS7740	26,160	205.74
4	152030228000	TUBE OD44.45 X 9.6 X 8000 - UNS7740	40,608	361.53
5	152030230001	TUBE OD50.8 X 4 X 10000 -UNS7740	2,850	14.39
6	152030240001	TUBE OD50.8 X 5.6 X 10000 -UNS7740	3,520	23.96
7	152030250001	TUBE OD50.8 X 7.6 X 10000 -UNS7740	1,530	13.46
8	152030260001	TUBE OD57.15 X 4 X 10000 -UNS7740	170	0.97
9	152030278000	TUBE OD57.15 X 9.6 X 8000 -UNS7740	632	7.71
10	152030280001	TUBE OD63.5 X 4 X 10000 -UNS7740	28,130	180.82
11	152030290001	TUBE OD63.5 X 5.08 X 10000 -UNS7740	35,170	281.50
<b>Total</b>			<b>221,180</b>	<b>1,575.46</b>

**Supply: as per BHEL TDC:0:131 Re No:01 Dt:11/ 08/ 2025**

**Delivery: 12 Months from the date of manufacturing clearance by BHEL for each size and qty.**

**BHARAT HEAVY ELECTRICALS LIMITED**  
**MM/RM/PURCHASE/TUBES**

**Ref: MM:AUSC:Alloy740H Tubes:Rev 00**

**Dt:27.08.2025**

**Pre-Qualification requirements (PQR) for the procurement of Seamless Tubes of ASTM B983-21 UNS N07740 (ASME code case 2702-7) as per TDC:0: 131 Rev No:**

**01**

**A) Organizational Capability:**

1. Manufacturers having tube mill are only eligible to participate. Offer from traders, fabricators and stockists are not acceptable and will not be considered for evaluation.
2. If the manufacturing supplier is having only cold mill facility for conversion of mother hollows to finished tubes, the source of mother hollow shall be declared along with the offer for BHEL/NTPC approval. For the submitted mother hollow sources, the manufacturing supplier shall submit original test certificate/s of mother hollow along with product test certificate/s.
3. If the manufacturing supplier is not having steel making facility, then source of raw material (bloom / billet) for the manufacturing of tubes shall be from IBR approved well known steel maker or certified by IBR approved inspecting authority (Form-IV to be attached). If the supplier is dependent on more than one source for steel making, all the sources should be indicated, and the supplies should be restricted to the indicated list of raw material sources. Acceptance of raw material source shall be subject to BHEL/NTPC approval.
4. Manufacturing supplier shall indicate the nature of the firm. Product catalogue shall be submitted.
5. Manufacturing supplier shall submit filled in supplier facility report for Tube mill (Format enclosed). Suppliers without manufacturing facilities in-house like cold pilgering / Heat treatment/ immersion UT facilities etc., as mentioned in the Supplier facility report shall not be considered for evaluation.
6. In house facilities for Heat treatment & Non-Destructive Testing (On-line UT with recording facility & Online Thickness Measurement facility for Tubes) are mandatory requirements for consideration of the offer.
7. Chemical, Mechanical testing shall be done in house or at Labs certified as per ISO 17025 or Government approved labs.

8. Suppliers shall submit a valid ISO 9001 certificate or Quality Assurance Manual or Written down procedure.

**B) Technical Competence:**

1. Point by point confirmation to the TDC requirements is mandatory for consideration of offer and signed TDC confirming adherence to all the TDC Clauses shall be submitted.
2. Suppliers shall submit manufacturing process flow chart (Raw material to finished product), which shall be in alignment with the TDC requirements, along with technical bid.
3. Suppliers shall submit their experienced manpower details specific to Manufacturing, Quality and NDE requirements.

**C) Past Experience/ Performance:**

1. Suppliers shall indicate their annual installed capacity for the tendered specification and it shall be more than the tendered quantity for each specification.
2. Suppliers shall have supplied Seamless tubes of Ni based alloy grades typically covered under ASTM B163/B167/B423/B444/B983 etc., in past 5 years. In this regards, the following are to be furnished.
  - a) Details of supplies made indicating the Quantity, Size, Specification & Customer details shall be submitted year wise.
  - b) Unpriced PO copies & Proof of supply (such as invoice / bill of lading copies and sample test certificates) shall be submitted.
3. The manufacturing size range shall be indicated in the offer. However, if credential is not available for any specific tendered size, then specific declaration shall be submitted by mill stating the capability to produce that quoted size/s.

“For example: if vendor manufactured Ø52mm and quoted for Ø76.2mm, the vendor has to declare that they will be capable upto Ø 76.2mm in their letter head.”

**D) Financial Soundness:**

1. Indigenous suppliers shall submit Audited copies of Balance Sheets, Profit & Loss statement for the last three financial years ending one month prior to the issue of the tender (or from date of incorporation whichever is less).

2. Foreign suppliers shall submit latest report from a reputed third party business rating agency like Dun & Bradstreet, Credit reform etc.

Additional details required: (not mandatory and these shall be submitted additionally for establishing the credentials)

1. Approval certificates issued by international agencies such as Lloyds, TUV etc.
2. Well known steel maker certificate issued by IBR.

**The Vendor shall provide undertaking for the following points:**

1. BHEL/NTPC reserves the right to inspect the item ordered at any stage at vendor's works and if found not meeting the stipulated conditions, material is liable for rejection.
2. BHEL/NTPC reserves the right to inspect the first lot of materials at vendor's works for giving clearance before bulk production.
3. BHEL/NTPC reserves the right to visit supplier's works for assessment and inspection (including successful process demonstration of the tendered specification) to ensure the capability for technical evaluation.
4. Upon receipt of PO, detailed quality plan & UT procedure shall be submitted to BHEL/NTPC for approval.

**Necessary supporting documents shall be submitted for meeting each of the above Pre-Qualification Criteria for evaluation of the offers.**

**BHEL shall consider/Not-consider the offers based on the evaluation of documents submitted for the above Pre-Qualification Criteria.**

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**Seamless ASTM B983-21 UNS N07740 code case 2702-7**  
**Supplier facility report**

<b>S.No</b>	<b>Description</b>	<b>Supplier comments</b>
1	Name of the company	
2	Address of the registered office (Telephone, Email, contact person)	
3	Factory Location and address (Telephone, Email)	
4	<b>Installed Manufacturing capacity</b> for Inconel tubes of tendered specification manufacturing	
5	<b>Raw material source for ASTM B983-21 UNS N07740 code case 2702-7</b>	
6	<b>Tube Manufacturing details</b>  Method of Manufacturing <ul style="list-style-type: none"> <li>Type &amp; make of Hot Mill along with the details of the individual equipments</li> <li>Type &amp; make of Cold Mill along with the details of the individual equipments</li> </ul> <b>Vendor has to submit the</b> <ul style="list-style-type: none"> <li><b>List of manufacturing facilities, (equipment, make, capacity &amp; installed year)</b></li> <li><b>Process flow chart</b></li> <li><b>Detailed Manufacturing quality plan.</b></li> </ul>	
7	<b>Heat treatment Furnace details</b> <ul style="list-style-type: none"> <li>a) Capacity of Furnace/Hr</li> <li>b) Number of Furnaces</li> <li>c) Type of Heat treatment carried out (batch or continuous)</li> </ul>	
8	<b>Inhouse testing equipment details</b> <ul style="list-style-type: none"> <li>a) Immersion UT facility</li> <li>b) Eddy current (EC) facility</li> <li>c) Hydro Test facilities (indicate the maximum pressure)</li> <li>d) Chemical &amp; Mechanical Testing Facilities</li> </ul>	

**Seamless ASTM B983-21 UNS N07740 code case 2702-7**  
**Supplier facility report**

	<b>List of testing facilities to be submitted.</b>  <b>Immersion UT machine should have online wall thickness measurement, defect sorter and capable of testing as per our TDC requirements with UT graph recording.</b>	
9	UT procedure, testing plan & procedures to be submitted before start of manufacturing upon placement of PO  Individual final test tube UT graph records to be submitted upon placement of PO.  Heat treatment charts to be submitted.	
10	Detail of Accreditation for Quality systems (like ISO, API, etc.)	
11	Are your firm approved by CBB for IBR well Known Tube/Pipe maker?  BIS license for the tendered specification if available.	
12	Are your approved by any Third party/statutory agency? If so, specify the agency	
13	Please Confirm the manufacturing range & testing facility of the following sizes OD: 14 to 76.2mm WT: 1.65 to 14.1mm Length: 6m to 13m  Supply details of the tendered specification to BHEL or any other well-known boiler manufacturer for Boiler application. Please provide the details to whom, when and how much supplied.	
14	Please go through the attached TDC:0:131 Rev No:01 and give point by point confirmation	

Place:

Date:

Signature with seal

Note: Enclose additional sheets/Annexures whenever required referring the Sl. No of this format.



**Product: Seamless Tubes of ASTM B983-21 UNS N07740 (ASME Code Case: 2702-7) coupled with supplementary requirements for Super Heater Coils of Advanced Ultra Supercritical (AUSC) Boilers**

#### Record of Revisions:

Rev 00: 05/11/2024: Fresh Issue

Rev 01: 11/08/2025: Cl. 1. Straightness requirements modified. Cl 3. OD variation tolerance modified Cl 5. 'Room temperature' included for Tensile test, Removed Impact Test. Cl. 5 Grain size number redefined. Cl 6. Modified check for each tube in delivery condition. Cl 6. Removed Hydro Test. Cl 10. Rejection reason modified attributable to Raw-material.

### 1. MATERIAL SPECIFICATIONS:

The starting material for finished tubes (Cold drawn/ Cold Pilgered) shall be hot extruded mother hollows obtained from round bars.

All the codes, standards, specifications, drawings & procedures, etc., referred in this TDC shall be of latest revision as on the date of Enquiry or Purchase Order, whichever is earlier, unless specified otherwise.

Inconel 740H : ASTM B983-21 UNS N07740 (ASME Code Case: 2702-7) coupled with supplementary requirements  
Additional Requirements : As listed below (Supplementary to above material specifications)  
Size and Quantity : As per Purchase Order.

### 2. CHEMICAL COMPOSITION & PROCESS:

- Melting:** Material shall be produced by using vacuum induction melting (VIM) followed by vacuum arc re-melting (VAR) or electro slag refining (ESR). Melting process employed shall be indicated in the test certificate.
- Product Analysis: Chemical composition as per Table 1
- Ingot Analysis in weight % as per Table 1: Test method as per ASTM B880-14.

**Table 1. Chemical composition**

Element	Cr	Co	Al	Ti	Nb + Ta	Fe	C	Mn	Mo	Si	Cu	P	S	B	Ni
Wt% min	23.5	15	1.1	1.0	0.5		0.005							0.0006	Remainder
Wt% max	25.5	22	2.0	1.9	2.2	3.0	0.08	1.0	2.0	0.3	0.5	0.025	0.02	0.005	Remainder

- Tolerance for chemistry shall be as per the applicable material specification specified in Cl 1.
- Raw materials used in making of tubes including incoming scrap shall be checked by suppliers to ensure freedom from radioactivity.

### 3. DIMENSIONS AND TOLERANCES:

Dimensions shall be as per Drawing and/or Purchase Order. Permissible outside diameter variation is according to Table-2 of ASTM B829. Permissible wall thickness variations: --0% and +20% of the specified minimum wall thickness.

**Straightness:** The tubes shall be reasonably straight and free of bends and kinks. Sharp contours at the end or kink and twist are not acceptable and if found so, the tubes will be summarily rejected.



**Product: Seamless Tubes of ASTM B983-21 UNS N07740 (ASME Code Case: 2702-7) coupled with supplementary requirements for Super Heater Coils of Advanced Ultra Supercritical (AUSC) Boilers**

#### 4. HEAT TREATMENT (HT):

- a) **Tubes:** All tubes shall be supplied in the solution annealed condition, whose solution annealing shall be performed in a temperature range of 1110-1180 Deg. C and holding time in line with ASTM B983. Local heat treatment is not permitted. All tubes shall be water quenched after solution annealing.

All tubes supplied in the solution annealed & water quenched condition shall be marked with the suffix 'Y' immediately following the Specification number and preceding any other suffix. The 'Y' suffix shall not be removed until the material specification requirements for aged material have been completed and the material test report supplemented.

Solution annealed & water quenched tubes shall be mechanically tested as per Cl 5 (a) of this TDC.

- b) **Test Samples:** The material supplier shall carryout the full solution annealing (and subsequently water quenching) and precipitation hardening (aging) on the test samples as per ASTM B983. Aging shall be carried out at 760-815°C for 4 hours minimum up to 2 inch (50 mm) of thickness plus additional ½ hour for each inch of thickness above 2 inches. Ageing shall be followed by air cooling, as defined by ASTM B983-21 from the delivery batch to demonstrate compliance with the delivery conditions of the code case. The extent of testing shall be as per ASTM B983-21.

Samples shall be tested at supplier works after carrying out above heat treatments and the results shall be in line with Cl 5 (b) of this TDC. Additionally, one sample per size shall be sent to BHEL for testing and verifying results as per Cl 5 (b). Heat treatment charts for both solution annealing and ageing shall be furnished by the supplier.

#### 5. MECHANICAL TESTS:

- a) **Tests on solution annealed & water quenched tubes:**

- Extent of test: One sample/each size/heat/HT batch.
- Tensile Testing at Room Temperature shall be in accordance with ASTM E8. Yield and tensile strength test results shall be reported to BHEL for information. Elongation in 2-inch specimen or equivalent: min 30%.

- b) **Tests on solution annealed, water quenched & precipitation hardened (aged) samples:**

- Extent of test: As per ASTM B983-21.
- Tensile Testing at Room Temperature as per ASTM E8. Tensile Strength: Min 1035 MPa; Yield Strength (0.2% offset): Min 620 MPa; Elongation in 2 inch specimen or equivalent: min 20%.
- Average Grain size number (tested as per ASTM E112): 1-5.

- c) Creep testing shall be carried out on samples taken from finished tubes in solution annealed and aged condition. Creep testing shall be done as per ASTM E139 (latest) or BS EN ISO 204 (latest). The test shall be conducted for not less than 1000 hrs, at the following parameters:

Temperature: 814 Deg. C, Stress: 136 MPa.

Two Test specimens each shall be prepared from the tube samples, preferably M 10 round sample. The tube samples for creep test shall be identified by BHEL or BHEL authorised TPIA, as necessary.

**Acceptance Criteria:** Both the samples tested shall not rupture and shall meet the creep requirements indicated above.





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For tubes manufactured in India, the creep testing shall be carried out at National Metallurgical Laboratory, Jamshedpur, Corporate Research & Development Laboratory of Bharat Heavy Electricals Limited, Hyderabad, or any other Material Testing Laboratory recognized by the Central Boiler Board. For tubes manufactured in other countries, the test shall be conducted at a Nationally recognised/ accredited testing laboratory for creep testing in the country of manufacture.

## **6. NON-DESTRUCTIVE EXAMINATION:**

Each finished tube in delivery condition shall be examined for its integrity of full section over its entire length.

- a) Ultrasonic Testing (UT):** For thickness equal to and greater than 3.6 mm, UT shall be conducted as per ASTM E213. Calibration: 2 axial notches (one ID & one OD) and two transverse notches (one OD and one ID) shall be used to standardise the system settings (to draw DAC). Notch shall be of length 50mm or less (minimum 20mm) and depth 5% (maximum) of nominal thickness of job (Minimum depth shall be 0.3 mm and maximum 1.5mm). For OD less than 30mm, one notch in outer surface (OD) is sufficient for calibration. The direction of scanning shall be clockwise and anti-clockwise for circumferential scan to find longitudinal discontinuity and for axial scanning to find transverse discontinuity. Scanning shall be done with scanning sensitivity of reference level plus 6 dB. Evaluation shall be carried out with reference sensitivity.

**Acceptance criteria:** Any discontinuity crossing the DAC shall not be acceptable. All indications larger than DAC shall be rejected.

## **7. WORKMANSHIP AND FINISH:**

The material shall be uniform in quality and temper, smooth and free from imperfections that would render it unsuitable for use as per clause 7 of ASTM B829-19a. No repairs/weld repairs shall be permitted. Tubes to be cleaned by pickling or pickling and surface preparation including grinding, bore blasting or honing.

## **8. MARKING & PACKING:**

Details to be identified: On Each Tube 1) PO Number, 2) Maker's emblem/code, 3) Specification, grade & Code Case Number, 4) Heat number, 5) Size (OD x Thickness x Length, in mm), 6) No. of Tubes, 7) Inspector's seal, 8) Condition: Cold Finished, 9) Tube minimum wall thickness designation.

- i) Upto OD 31.8 mm (Excl.) – Sl.No: 1 to 9 to be stamped on metal or plastic tag attached to bundle or continuously ink marked.
- ii) OD 31.8 to OD 76.1mm (Incl.) – Sl.No: 1 to 5, 8 & 9 to be paint stencilled or continuously ink marked on each tube. Sl No: 1 to 9 to be stamped on metal or plastic tag attached to bundle.
- iii) OD > 76.1 mm - Sl.No: 2 to 5 and 7 to be hard stamped with round edged stamp at 100mm from an end of each tube and 1 to 5, 8 & 9 to be paint stencilled on each tube.
- iv) Additionally, mark with the suffix 'Y' immediately following the Specification number and preceding any other suffix. The 'Y' suffix shall not be removed until the material specification requirements (solution annealing and precipitation hardening heat treatments) have been completed and the material test report supplemented. The 'Y' suffix is not required for material supplied in the solution annealed and aged condition.

Finished tubes of Thickness  $\leq 2.5$  mm to be packed in boxes and others in bundles. Tubes of thickness  $\geq 6.5$  mm and OD  $\geq 88.9$  mm can be shipped loose. Bundles to weigh  $\leq 4$  tons comprising equal no. of tubes, fastened with Nylon strap at both ends as well as at 1m (max) interval in between. Wooden pallets to cover tubes are not permitted. Tube ends shall be closed with plastic end caps / plugs or packed in wooden boxes with protective wrapping and secured for storage.



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## 9. INSPECTION & CERTIFICATION:

- a) Products shall be inspected at supplier's works/mill and the applicable IBR Form must be countersigned by the Inspecting Authority as indicated below in case the supplier's works/mill is not recognised as a "Well known Tube Maker" under IBR:
- ☐ **Imported Items:** Inspecting Authority approved by IBR for the Country of origin.
  - ☐ **Indigenously Supplied items:** Director of Boilers/Chief Inspector of Boilers/Inspecting Authority approved by IBR, for the respective state in India.

Certification in IBR Form III-B from "IBR-Well Known Tube Maker" or "Inspecting Authority", as applicable, to be submitted. IBR Form III-B & separate Test certificate in English language (with following details), shall accompany the products:

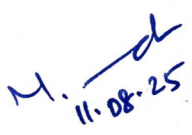
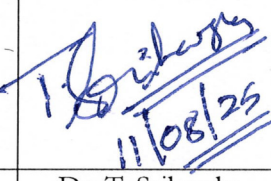
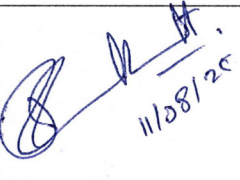

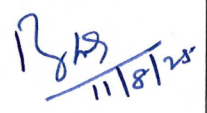
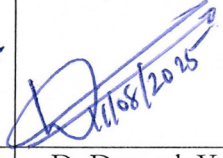
1. Purchase Order No.(BHEL), TDC No & its revision no, Test certificate no & date.
2. Specification, Grade & class with applicable year of code, Code case number, Heat Number, Drawing No, Quantity & Size.
3. Test Certificate shall categorically indicate marking with the suffix 'Y' immediately following the Specification number (i.e., ASTM B983-21 UNS N07740 Y) for material supplied in solution annealed condition.
4. Supplier TC used in making the finished product (well known and others in IBR Form IV).
5. Melting & tube process, Chemistry (Ingot & Product analysis). Elements defined in table 1 of TDC shall be reported: Heat number-wise.
6. Heat treatment and soaking details on tubes and samples used for mechanical testing.
7. Heat treatment charts shall be furnished by the supplier.
8. Mechanical test results on solution annealed tubes and aged samples - Tensile (UTS), YTS (0.2% offset), % elongation, grain size (on samples).
9. NDE (UT) test results with reference & acceptance standards.
10. Hydrostatic test results (with holding pressure, time and test results).
11. Results of Dimensional Checks.

## 10. AUDIT CHECKS AT BHEL:

BHEL reserves the right to carry out audit checks for chemistry, HT condition, mechanical test and NDT on representative test specimens. Supplies found non conforming during check or subsequent processing including aging treatment at BHEL will be liable for rejection, for reasons attributable to raw material quality.

## 11. END USE

The finished tubes are intended to be used for super heater coils in Advanced Ultra-Super Critical (AUSC) boiler applications and are expected to perform optimally under these conditions.

 11-08-25	 11/08/25	 11/08/25	 11/08/25	 11/8/25	 11/08/2025
M. Manoj Pandi	Dr. T. Sriharsha	Dr. R. Ravibharath	S. Anand Kumar	P.K. Ramesh Kumar	Dr. Deepesh V
MGR /QA	SM /QA	SM/WRI	SDGM/PE/FB	AGM/MM	DGM/QA
Prepared By	Reviewed By				Approved By