An ISO 9001
Company

Bharat Heavy Electricals Limited
(High Pressure Boiler Plant)
Tiruchirappalli – 620014, TAMIL NADU, INDIA
MATERIALS MANAGEMENT

PROCUREMENT OF DIN STANDARD TUBES TO THE SPECIFICATION PB-M-96 & 15 Mo3	Phone: **+91 431 2577447** Fax : **+91 431 252 07 19** Email : **agk@bheltry.co.in**

	Reference Number: Enquiry 1501100111	**Enquiry Date: 18.10.2011**	**Due date for submission of quotation: 08.12.2011**
You are requested to quote the Enquiry number date and due date in all your correspondences. This is only a request for quotation and not an order			

Sub: Requirement of additional sources for supply of DIN STANDARD TUBES.

BHEL/Trichy is looking for empanelment of new vendors for supply of tubes as per annexure.

BHEL commercial terms & conditions, other additional conditions for submission of offers and all annexure can be downloaded from BHEL web site http://www.bhel.com under enquiry reference "**1501100111** "

Tenders should reach us before 14:00 hours on the due date Technical bid will be opened at 14:30 hours on the due date Tenders would be opened in presence of the tenderers who have submitted their offers and who may like to be present.	Yours faithfully, For **Bharath Heavy Electricals Limited** SM/ PURCHASE / MM / MFG

BHARAT HEAVY ELECTRICALS LIMITED

(A Government of India Undertaking)
HIGH PRESSURE BOILER PLANT
PURCHASE DEPARTMENT - FOSSIL BOILERS
THIRUCHIRAPALLI - 620014
TAMILNADU (INDIA)

PHONE :2577447
GRAMS : BHARATELEC
FAX NO: 2520719
E-mail: agk@bheltry.co.in
Web:

ENQUIRY

Enquiry No	Enquiry Date	Due Date for Quotation
1501100111	18.10.2011	08.12.2011

Please quote Enquiry No, Date and due date in all correspondences.
This is only a request for quotation and not an order

Item	Description	Unit	Quantity	Delivery Quantity	Schedule Date
10	D13130101025 POD 48.3 x4thk x MIN LENGTH 600- 760Nos (or in multiples of 600mm length) as per specification DIN 17175 -15Mo3 and DIN17175-test class III- in normalized condition and UT tested as per SEP1915,1918,1919. Hydrotested at 80 bar.WIth plain ends. (or) SA335GRP1 meeting UT and hydro test requirement as mentioned above the supplier shall quote seperately the testing charges.	M	456.000	456.00	13.03.12
20	D13130101157 TOD 25 x 4thk x 5000lg- 224 Nos as per specification DIN 17458. 1.4571h and PB-M-96 - test class II and tolerance as perD3,T3 of DIN2462.	M	1120.000	1,120.00	13.03.12

General Note:

1) Bidders shall submit the OFFER in English language (a single envelope containing two inner envelopes) as indicated below:
Envelope 1: This sealed envelope should contain
(a) technical bid
(b) un-priced commercial bid (copy of the Priced Bid without the price details)
This envelope should be clearly marked "Part I - Technical and Un-priced commercial bid, indicating Enquiry No., Due Date, Address & Reference of the Bidder.

Envelope II: This sealed envelope should contain price details. This envelope should be clearly marked "Part II - Price bid", indicating Enquiry No., Due Date, Address & Reference of the Bidder.

2) The OFFER, sealed and Superscribed as "Parts I & II inside" indicating Enquiry No., Due Date, Address & Reference of the Bidder should reach this office on or before the due date by 14:00 Hrs (IST). OFFERS RECEIVED AFTER 14:00 Hrs (IST) WILL NOT BE CONSIDERED FOR EVALUATION.

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VIGILANCE AWARENESS WEEK
31ST OCT-5TH NOV 2011
IF YOU HAVE ANY COMPLAINT /GRIEVANCES
YOU MAY CONTACT GM/VIGILANCE
PHONE:0431-2577962,2520334 EMAIL: bhel@bheltry.co.in

Yours faithfully,
For **BHARAT HEAVY ELECTRICALS LIMITED**

A. GOPALAKRISHNAN
Sr. Manager
M/I / Purchase / Tubes
BHEL, Tiruchirappalli - 620 014.

MANAGER / PURCHASE
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E-mail: agk@bheltry.co.in
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1501100111 / 18.10.2011

The OFFER is to be addressed to:
SR. MANAGER / PURCHASE - TUBES / MM / MFG
4th Floor - Building 24
BHARAT HEAVY ELECTRICALS LIMITED
HIGH PRESSURE BOILER PLANT TIRUCHIRAPALLI - 620 014
TAMIL NADU, INDIA.

3) Tenders should be free from CORRECTION AND ERASURES, Corrections if any, must be attested. All amounts shall be indicated both in words as well as in figures. Where there is difference between amount quoted in words and figures, the lesser amount shall prevail.

Note: Bidders are requested to submit their offers only through sealed bids. As the part II (priced bid) will not be opened before the technical evaluation is completed, bidders are requested not to submit their bids through email/fax etc

4) Fixed price: All items should be quoted on "Per unit basis". Prices quoted by the bidder shall be fixed and not subject to any escalation whatsoever during the period of bid validity and execution of the Purchase Order. A bid submitted with an adjustable price will be liable for rejection. Prices shall be written in words and figures. In the event of any discrepancy with regard to total price and unit price whichever is less shall be considered correct. All rates should include the third party inspection charges. RATES QUOTED SHALL BE INCLUSIVE OF ALL CHARGES INCLUDING PACKING, INSPECTION ETC. NO EXTRA PAYMENT WILL BE MADE IN ANY CASE.

5) Bid currency: Indian bidders should submit the prices only in Indian Rupees. Foreign bidders may submit their bid in their preferred currency. For the evaluation purposes the exchange rate on technical bid opening date will be considered.

6) Terms of Delivery: Foreign Bidders should submit their offer for net FOB, Nearest port and CFR, Chennai with freight break up details. BHEL reserves the right to order on FOB or CFR basis. Hence if FOB rates are not quoted in the offer, it is liable to be rejected. Indian Bidders should submit their offer for FOR, Trichy (inclusive of risk in transit) & Ex-Works with the applicable freight breakup details.

7) Taxes and Duties: (for Indian Bidders only) All Taxes and Duties payable as extra to the quoted price should be specifically stated in offers along with CST & TNGST No / Tariff No. etc., failing which the purchaser will not be liable for payment of such Taxes and Duties.
Our T.N.G.S.T No. 3560005 Dt. 01-04-1995, C.S.T. No. 239383 dt. 11-06-1991.
The duplicate copy of the invoice meant for transporters should

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PHONE:0431-2577962,2520334 EMAIL: han@bheltry.co.in

Yours faithfully,
For **BHARAT HEAVY ELECTRICALS LIMITED**

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Sr. Manager
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1501100111 / 18.10.2011

accompany the material as stipulated under Central Excise rules 52A and 173C or 57gG. A Photostat copy of the invoice for each delivery challan should be submitted along with the original bills routed through bank or if submitted directly to BHEL finance department.

8) Modvat credit : (for Indian Bidders only) If any Excise Duty is payable, the chapter head / sub-head reference and the rate of the duty should be quoted. If the tender is availing MODVAT credit for his input material, the effect of proforma credit should be passed on to the purchaser. The Bidder under 'MODVAT' shall be preferred.

9) Validity: The offers shall be kept open for acceptance for 90 days from the date of Tender opening. Once the tenders are submitted, rates cannot be changed on any grounds.

10) Terms of Payment :
Indian Bidders - The payment term is 100% payment after 45 days of satisfactory acceptance of materials at BHEL, Tiruchy. As per policy, LC will not be opened. Offers with LC requests/advance payments are liable for rejection.
Foreign Bidders - Cash against documents - Payment will be made 45 days from the date of submission of complete set of documents as specified in the PO at our bank.
Requests for LC will be loaded at 1.5% of the basic charge.

11) BHEL prefers the manufacturers to quote directly. In case this is not possible and the offer is being submitted by an Indian agent, the following details are to be furnished along with the offer:
a. The letter from their Principal authorising the Indian agent to submit the offer on their Principal's behalf. In case the Indian agent submits offer on their own letter head then a covering letter (in original) from the Principal should be enclosed, clearly mentioning that they are bound by the offer submitted by the Indian agent on their behalf.
b. Precise relationship between foreign suppliers and their Indian agents and their mutual interest in business, should be clearly spelt out.
c. Any payment, which the agent receives in India or abroad, from the foreign supplier, whether as a commission or as a general retainer fee is to be mentioned in the offer.
d. All services to be rendered by the agent, whether of general nature or in relation to the particular contract, must be clearly stated by the foreign supplier and the Indian agent.
e. The amount of agency commission agreed to between the foreign principal and the Indian agent should be specifically disclosed and the agency commission will be paid in Indian Rupees only on satisfactory completion of the contract.

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f. For calculation of rupee equivalent of agency commission, exchange rate as prevailing on the date of order will be taken.
g. Copy of current agency agreement is to be enclosed without which the offer is liable for rejection.

12) Bank Guarantee (BG) for import bidders: The Bidder, in the event of an order, should furnish a bank Guarantee from any one of the attached list of consortium banks or counter-guaranteed by any one of this list of banks, at no extra cost in a Performa which will be provided by BHEL along with the order, for an amount equivalent to 10% (Ten percent) of the value of the contract. The Bank Guarantee should remain in full force and effect during the period that would be taken for successful completion of the contract and shall continue to be enforceable till 12 months from the date of receipt of consignment at purchaser's site or 18 months from the date of last shipment at the port of delivery whichever is earlier, with a claim period of two months.

13) Liquidated damages : Where the seller supplies or despatches the goods, Liquidated damages at the rate of 1/2% of the value of goods delayed for each week of delay or part thereof, subject to a maximum of 15% of the order value will be levied.
LD, if applicable, will be levied from the order delivery date to the date of Bill of lading/LR in case of CFR/FOR contracts and to the date of the inspection in case of FOB/Ex-Works contracts. Grace periods are not acceptable.

14) Risk purchase : Alternatively the purchaser at his option will be entitled to terminate the contract and to purchase elsewhere at the risk and cost of the seller either the whole of the goods or any part which the supplier has failed to deliver or despatch within the time stipulated as aforesaid or if the same were not available, the best and the nearest available substitute therefore. The supplier shall be liable for any loss which the Purchaser may sustain by reason of such risk purchases in addition to penalty at the rate mentioned under liquidated damages.

15) The correspondence between the bidder and BHEL through email is considered to be valid document legally though not signed. It is treated as valid confirmations made on behalf of the respective company and comes under the legal ambit of the business transaction and hence binding on both the parties.

16) Bidders participating in the tender should declare in their technical bid whether they have been black-listed / kept on hold / given Business holiday for a specified period by any Public Sector Undertaking or Government Departments. The reasons for such action with details and the current status of such hold shall be clearly furnished to BHEL. If no such details are mentioned in the offer, it will be construed that

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YOU MAY CONTACT CMO/VIGILANCE
PHONE:0431-2577862,2520154 EMAIL: hsn@bheltry.co.in

Yours faithfully,
For **BHARAT HEAVY ELECTRICALS LIMITED**

A. GOPALAKRISHNAN
Sr. Manager
MM / Purchase / Tubes
BHEL, Tiruchirappalli - 620 014.

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the bidder is not under any such hold. However, at a later date if it comes to the notice of BHEL about any such hold under enforcement, BHEL reserves the right to reject the offer at any point of time and also under any stage of the finalisation of the tender. Such bidders will not be permitted to participate in the further tender proceedings and will be communicated suitably.

17) Packing and marking : The Supplier shall arrange for securely protecting and packing the stores to avoid loss or damages during transit.

18) Lowest price received against BHEL tenders need not be the technically acceptable one and in that case, BHEL reserves the right not to consider the same.

19) BHEL reserves the right to negotiate L1 rate or re float the tender opened if L1 price is not the lowest acceptable price to them inter-alia other reasons.

20) Any other conditions which might have been quoted by the seller and are in contravention to the terms prescribed in the order and which have not been specifically accepted in by purchaser will not be applicable to the contract.

20) The length of tubes are to be supplied as per the description mentioned. Any variation in length may please be mentioned in the offer itself.

21) The actual production of materials is permitted only after review/approval of manufacturing/testing/ Inspection drawings /documents and quality assurance plans (QAP) by BHEL, Tiruchy.

22) Five sets of additional dialects containing test certificates, copies of the approved procedures DCR, Drgs etc apart from contractual requirements are required. SUBMISSION AND ACCEPTANCE OF TEST CERTIFICATES IS SPECIFICALLY REQUIRED BEFORE DISPATCH.

23) We require all these tubes to be supplied positively before March 2012.

24) Vendors should indicate confirmation of specification point by point as applicable to the tender. Deviation, if any, with respect to specific clauses should be clearly spelt out in the offer.

25) End use certificates will not be given.

26) The following are to be ensured for item no 20 -
,,a. Chemical composition shall be as per DIN17458 1.457ih(X6CrNiNoTi

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YOU MAY CONTACT GM/VIGILANCE
PHONE:0431-2577962,2520334 EMAIL: [illegible]

A. GOPALAKRISHNAN
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Yours faithfully,
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17122). We accept equivalent Euro standard EN10216-5:X6CrNiMoTi 17122 alternate to the DIN standard. We also accept hot tensile test as per EN10216-5 table 9 in place of PB-M-96.
,,b. As per PB-M-96, steel melting process shall be EAF, VOD and ,,fully killed. Other process will not be acceptable.
,,c. Supply condition for the tube shall be -'h'-[DIN17458 ,,page7] Type of condition of tube: Cold worked, heat treated ,,and pickled. Surface finish: Metallically bright-pickled, ,,smoother. We also accept surface finish CFG para 7.2.4.table1 in EN10216-5(cold finished, heat treated, ground, bright annealed + OD grinding/polishing)
,,d. Ferrite content in the molten base metal indicated in the PB-M-96 shall be determined for each melt and for each heat treatment batch. The ferrite value is acceptable upto 2.9%.
,,e. High temperature tensile test at 350 degree celsius shall be carried out from each heat treated batch.
,,f. Tolerance on OD and WT of the tube[DIN2462-ISO Tol. Class ,,D3;T3] - Permissible deviation on OD-D3 is +/-0.75% ,,min,+/-0.3mm. Permissible deviation on WT is T3 +/-10% min ,,+/-0.2mm.

27)The following is to be ensured for item no 10 -
,,a. Chromium content should be 0.1 to 0.3% on actual analysis. ,,b. Supplies to be as per DIN17175 and 15 Mo3.

28) BHEL/End customer reserve the right to inspect the item ordered at any stage at vendor's works.

29) Date of price bid opening will be informed later after acceptance of offer on technical ground.

30) INPSECTION AGENCY - For import vendors, inspection should be by TUV (Nord) or BV or SGS. Offer should indicate the name of inspection agency.
For indigenous vendors, inspection will be by BHEL, Trichy & NPCIL.

31) Offers will be evaluated on the basis of financial lowest status on technically suitable offers.

32) IN ADDITION TO THE TECHNICAL AND COMMERCIAL CONDITIONS LISTED ABOVE, VENDORS WHO ARE NOT REGISTERED VENDOR OF BHEL TRICHY HAVE TO SUBMIT THE FILLED IN SUPPLIER REGISTRATION FORMS AVAILABLE IN THE BHEL WEBSITE - www.bhel.com ALONG WITH THE TECHNICAL BID WITHOUT FAIL.

33) Bidders are to confirm all the above points in their "Technical and un priced commercial bid". Incomplete offers will not be considered.

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Yours faithfully,
For **BHARAT HEAVY ELECTRICALS LIMITED**

MANAGER / PURCHASE
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Enclosures:

"LD clause has to be confirmed without fail."

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SPECIFICATION

NO. PB-M-96

STAINLESS STEEL PLATES, FORGINGS, BARS ETC. FOR GENERAL APPLICATION

ISSUE

No.	DETAILS	INITIAL	No. OF PAGES	DATE
1	Original		4	May 88

COMPILED BY V.K. SHARMA REFERENCE FILE NO. SNP/33111

APPROVED BY CH. SURENDAR 6/5/88

6/5/88

STAINLESS STEEL PLATES, FORGINGS, BARS ETC. FOR GENERAL APPLICATION

1.0 SCOPE

This specification establishes the technical requirements for the material, manufacture, inspection, examination, testing and supply of stainless steel plates, forgings, bars etc. for general application. The requirements stated herein are additional technical requirements over DIN 17440 for the supply of material number 1.4550/1.4571.

2.0 Steel Melting

The steel shall be melted in an electric furnace, vacuu degassed and fully killed.

3.0 Supply Condition

Material supply condition C_2, e, h, etc. shall be as indicated with the material number in the purchase order.

4.0 Chemical Composition

Both ladle and product analysis shall meet the requirements of DIN 17440-1.4550/1.4571 as applicable.

5.0 Mechanical Properties

Mechanical tests at ambient temperature and high temperature tensile test at 350°C shall be carried out from each heat treated batch and shall conform to the requirements of DIN 17440. For bars over 100 mm. in diameter, the impact and tensile specimens shall be taken in transverse direction.

6.0 Corrosion Test

Intergranular corrosion test shall be carried out as per ASTM A 262 Case E with preceding heat treatment at 650°C/30 minutes.

7.0 Ferrite Content

For materials subjected to autogenous welding, the ferrite content in the molten base metal shall be determined for each melt and for each heat treatment batch. The ferrite content thus determined shall be within 5 to 10%. No net like arrangement is acceptable.

The melting of the base metal for this purpose shall be carried out using a TIG torch simulating the welding conditions which shall be furnished by the Purchaser on placement of order.

8.0 Dimensional check and visual examination

Each material shall be visually examined and checked for dimensional requirements as per Purchase Order.

9.0 Mix-up Test

Every material shall be tested to detect any inadvertent mixup.

10.0 Test Reports/Certificates

Five (5) copies of all test reports/certificates shall be sent to the purchaser immediately after completion of tests/inspection, prior to the shipment of the material. One set of test reports/certificates shall be despatched along with the material. Following reports shall be submitted:

a) Chemical Analysis (Ladle and Product) ✓

b) Heat Treatment details (heat treatment charts shall be sent after completion of the contract. ✓

c) Results of mechanical properties. ✓

d) Intergranular corrosion test report. ✓

e) δ ferrite measurement.

f) Visual and dimensional test report. ✓

g) Result of micrograph and grain size. ✓

h) Hardness values.

i) Ultrasonic examination and liquid penetrant examination. ✓

11.0 Marking and Identification

Each product shall be marked with the following information:

a) Heat number.

b) Direction of rolling (for plates),

c) Material designation.

d) Supply condition.

e) Manufacturers name.

f) Inspection agency/Purchaser's seal.

g) purchase order number.

12.0 Non Destructive Examination

12.1 Ultrasonic Examination:

All products shall be ultrasonically examined covering 100% of the volume. The forgings shall be examined in accordance with para 8.1 of PB-M-90. Other products shall be examined in accordance with the product specifications.

12.2 Liquid Penetrant Inspection:

All forgings in finished shape shall be examined by liquid penetrant method in accordance with ASTM-E-165 with following additional requirements.

a) Penetrants, developers and cleaning agents containing more than 25 ppm each of Sulphur and Halogens shall not be used.

b) Application of penetrant and developer from aerosol type of spray cans is preferred.

c) The temperature of the area examined shall not be lower than 10° C.

d) All traces of penetrant and developer shall be removed after completion of the examination.

Acceptance Standard:

Indications of any shape and size are unacceptable.

13.0 Repairs:

Repair is generally not permitted. Slight surface defects may be smoothly ground and blended without impairing the minimum wall thickness. No other repairs shall be carried out without prior approval of the Purchaser.

14.0 Quality Surveillance:

All material shall be subjected to quality surveillance by the Purchaser or his authorised agency during manufacture. The material shall not be supplied until the shipping release is given by the Purchaser or his authorised agency.

15.0 PACKING AND SHIPMENT

The materials shall be packed suitably with adequate bracing, and blocking to withstand transhipment and tropical storage for two years. The packages shall be released for shipment only after inspection and issue of "shipping release" by the purchaser or his authorised agency. Each box shall contain the test certificates in respect of the material contained. Details of items packed including material specification, Purchase order number and destination shall be clearly marked on the Packages.

DIN 17175

8.2 • Acceptance testings

Tubes to this Standard are only supplied with acceptance testings [1]. The type of acceptance testing certificates according to DIN 50 049 shall be agreed at the time of ordering. The acceptance testing [1] is subject to the requirements in Sections 8.3 to 8.8. In addition the requirements of Sections 8.5 and 8.6 apply also for subsequent testings in response to complaints.

8.3 General test conditions

8.3.1 All testings including acceptance shall be carried out in the manufacturers works such that the production flow is not unnecessarily impeded.

8.3.2 The manufacturing works shall take steps to prevent rejected tubes and those the repair of which is not permissible from being despatched to customer.

8.4 Extent of testing (see also Table 3)

8.4.1 The tubes shall be tested in batches. They shall be divided into batches of 100 tubes according to the grades of steel, quality grades and dimensions and in the case of alloy steels, if possible, according to cast. For tubes up to an outside diameters ≦ 51 mm the tubes must come from the same heat-treated batch. Surplus amounts of up to 50 tubes shall be distributed evenly between the individual batches. Number of pieces and surplus amounts between 51 and 100 tubes shall be considered as a complete batch.

8.4.2 • In the event of subsequent testing of the chemical composition of the finished tube having been agreed to at the time of ordering, this will normally consist of one testing per cast and delivery.

8.4.3 For the tensile test two tubes shall be tested from each of the first two batches, in accordance with Section 8.4.1, and one tube from each subsequent batch chosen by the inspector.

If a delivery consists of a batch containing a maximum of 10 tubes, only one tube shall be taken.

8.4.4 The absorbed energy shall be tested on the tubes selected according to Section 8.4.3 provided their nominal wall thickness has the following values:

for steel 14 MoV 6 3 and X 20 CrMoV 12 1 > 10 mm,

for the steel 15 Mo 3 > 20 mm,

for all other steels > 30 mm.

8.4.5 • If the 0.2 %-yield limit at elevated temperature is to be tested, this must be stated in the order together with the required test temperature; this extent of testing shall be carried out on one specimen per cast and dimension, unless otherwise agreed.

8.4.6 The tubes shall be ring-tested (see Table 14).

8.4.6.1 Quality grade I tubes selected according to Section 8.4.3 shall be ring-tested (allowing for the dimensions quoted in Table 14) using specimens taken from one end.

8.4.6.2 Quality grade III tubes shall be ring-tested on the rolled lengths allowing for the dimensions quoted in Table 14, with an extent of testing applicable all steel grades except for the steels 14 MoV 6 3 and X 20 CrMoV 12 1:

for tubes with an outside diameter ≦ 51 mm in Section 8.4.6.2.1

and

for tubes with an outside diameter > 51 mm in Section 8.4.6.2.2.

The extent of testing according to Section 8.4.6.2.3 applies for tubes of all dimensions of the steel grades 14 MoV 6 3 and X 20 CrMoV 12 1.

At a subsequent subdivision of the rolled lengths into partlengths no further test specimens need to be taken, provided suitable markings show that the part-lenghts belong to the tested rolled length. If this cannot be guaranteed, the testings on the rolled lengths shall be dropped and in their stead the part-lengths shall be tested as rolled lengths.

8.4.6.2.1 20 % of the rolled lengths of Grade III tubes ≦ 51 mm outside diameter – except tubes of steels 14 MoV 6 3 and X 20 CrMoV 12 1 – shall be tested at one end, i.e. random-wise such that the 20 % of the tubes requiring testing are chosen arbitrarily from the total batch. If ring-testing is performed on part lengths, which are not related to rolled lengths, 20 % of the part lengths shall be tested random-wise (see above) at one end. As far as heat-treated tubes are concerned steps must be taken to ensure that the part lengths come from batches which had been subjected to the same heat treatment. As far as tubes with hot-formed ends are concerned (see Section 6.3.1, paragraph 2) steps must be taken to ensure that the part lengths belong to batches from the same production run, i.e. an identical heating practice.

8.4.6.2.2 Quality grade III tubes > 51 mm outside diameter shall be ring-tested at both ends of each rolled length. Each part length which is not related to the rolled length, shall be tested at both ends.

Each part length from tubes > 51 mm outside diameter can also be ring-tested at one end only provided it has been verified once for the relevant manufacturing process and manufacturing works that the ring test performed on one end of a part length furnishes the same information as the information gained in a test with ring specimens taken from both ends of the original rolled length.

8.4.6.2.3 Each rolled length from quality grade III tubes manufactured from the steels 14 MoV 6 3 and X 20 CrMoV 12 1 shall be ring-tested at both ends, independet of the tube diameter. The same applies to the testing of part lengths.

8.4.7 The manufacturer shall non-destructively test all quality grade III tubes for longitudinal defects.

• A supplementary non-destructive testing for transverse defects and/or laminations can also be agreed on when ordering.

8.4.8 The internal and external condition of each tube must be checked.

8.4.9 The wall thickness, and depending on the order, either the outside diameter or the inside diameter shall be checked.

8.4.10 All tubes shall be tested for leak tightness; that is at the discretion of the manufacturer either by an hydraulic test or by a suitable non-destructive testing (e.g. Eddy current according to Stahl-Eisen Testing Sheet 1925).

8.4.11 The manufacturer shall submit all alloy steel tubes to an appropriate material identification testing.

8.5 Sampling

8.5.1 • If an agreement has been reached in the order to check the chemical analysis of finished tubes, for wet analysis the required turnings must be taken over the entire wall thickness of the tube; an appropriate procedure shall be adopted for spectro-analysis [4].

8.5.2 Flat testpieces in accordance with Section 8.4.3 normally extending over the entire wall thickness and cut longitudinally from the tubes shall be used for tensile testing. The testpieces must not be heat-treated nor straightened over the gauge length. The removal of local inequalities from the flat testpieces is permissible, but the rolling skin must be allowed to remain as far as it is possible on the thinnest sections of the test-piece.

Small diameter tubes can be tested as a whole.

The tensile test on tubes of ≧ 200 mm outside diameter can be done on transverse test specimen, provided this is compatible with the tube dimensions without requiring straightening. In this case a tube ring shall be cut off and halved.

8.5.3 A set of three DVM-specimens is taken in a transverse direction from the tubes selected according to Section 8.4.3 for the notch impact/bending test. The notch impact/bending specimens shall be taken in longitudinal direction from tubes of < 200 mm outside diameter.

8.5.4 • Section 8.5.2 applies logically in cases where agreement has been reached in the order on the determination of the 0.2 %-yield limit at elevated temperatures; since, where possible, hot tensile tests are normally performend on round test specimens sampling requires, if the occasion arises, prior agreement.

8.5.5 The specimens for the ring tests shall be taken according to DIN 50 136 (ring flattening test), DIN 50 137 (ring expanding test) and/or DIN 50 138 (ring tensile test) (see Table 3).

---

4) The sampling practice conforms, as a rule, to Stahl-Eisen-Prüfblatt 1805 – Probenahme und Probenvorbereitung für die Stückanalyse bei Stählen – (Sampling and sample preparation for the sample analysis of steels) – (Publisher: Verlag Stahleisen mbH, Düsseldorf).

5) Handbuch für das Eisenhüttenlaboratorium (Handbook for the Ferrous Metallurgy laboratory), Vol. 2: Die Untersuchung der metallischen Stoffe (The testing of metallic materials), Düsseldorf; Verlag Stahleisen mbH, 1966; Vol. 5 (supplement): A 4.1 – Aufstellung empfohlener Schiedsverfahren (Compilation of recommended arbitration analyses), B – Probenahmeverfahren (Sampling methods), C – Analysenverfahren (Analysis methods), always the latest edition (Verlag Stahleisen mbH, Düsseldorf).

8.5.6 All specimens for the tests according to Sections 8.5.2 to 8.5.5 shall be adequately identifiable in order to show which tubes and specimens go together.

8.6 Applicable test methods

8.6.1 The chemical composition shall be tested according to the methods [5] prescribed by the "Chemikerausschuss des Vereins Deutscher Eisenhüttenleute" (Chemists Committee of the Association of German Ferrous Metallurgy Engineers).

8.6.2 The tensile test shall be carried out according to DIN 50 145 using the short proportional test bar according to DIN 50 125 or with specimens according to DIN 50 140.

8.6.3 The notch impact/bending test shall be carried out at room temperature in accordance with DIN 50 115 using DVM-specimens. The notch shall be cut vertically to the longitudinal axis and the surface of the tube.

8.6.4 The 0.2 %-yield limit at elevated temperature is determined in accordance with DIN 50 145.

8.6.5 The ring tests shall be carried out in accordance with the standards covering the annular flattening tests, ring expanding tests and ring tensile tests listed in Section 8.5.5.

8.6.5.1 The ring expanding test shall be carried out according to DIN 50 137 where the change in the diameter of the specimen expanded to fracture shall also be measured. The evaluation of the deformability of ring expanding specimens is based on the appearance of the fracture and the fracture surfaces.

8.6.5.2 In the annular flattening test according to DIN 50 136 the specimens or tube ends shall be squeezed until the definite distance H is reached between the pressure plates. For this distance H in mm applies.

$$H = \frac{(1 + c) \cdot s}{c + s/d_a}$$

Where s = wall thickness in mm, d_a = outside diameter in mm and c is a constant. For the steel St 35.8 the c-constant is 0.09, for the steels St 45.8, 17 Mn 4, 19 Mn 5, 15 Mo 3, 13 CrMo 4 4 and 10 CrMo 9 10 it is 0.07 and for the steels 14 MoV 6 3 and X 20 CrMoV 12 1 it is 0.05.

• If the ratio s/d_a is greater than 0.15 the distance between the plates shall be negotiated.

If an annular flattening test is performed according to Section 8.4.6 the test can be continued to fracture or until a crack appears, so as to make it possible to assess the appearance of the fractured surface. The decisive factor is that the prescribed distance between the plates is reached without cracking

8.6.6 • The non-destructive test shall always be carried out before the ring specimens are cut off.

Non-profiled tubes shall normally be ultrasonically tested i.e.

a) according to Stahl-Eisen Test Sheet 1915 when testing tubes of ≧ 10 mm outside diameter, for longitudinal defects.

b) according to Stahl-Eisen Test Sheet 1918, after agreement has been reached, on testing tubes having an outside diameter > 133 mm, for transverse defects.

c) according to Stahl-Eisen Test Sheet 1919, after agreement has been reached on testing tubes having an outside diameter > 133 mm and a wall thickness > 8 mm, for laminations.

In cases in which the aforementioned testing methods are not applicable (such as when testing profiled tubes or tubes having outside diameters < 10 mm for longitudinal defects), agreement on the relevant testing method will have to be reached at the time of ordering.

8.6.7 Visual inspection [6] with the naked eye requires that:

a) the whole external tube surface shall be examined in suitable lighting for surface defects,

b) the entire inner tube surface shall be examined in suitable lighting from both tube ends for surface defects.

The surface finish of the tubes should permit detection of significant defects. For quality grade III tubes this generally denotes descaled surfaces, unless the chosen method of production or heat treatment ensures a suitable surface finish for visual inspection and ultrasonic testing.

8.6.8 The dimensions shall be checked with suitable instruments.

8.6.9 • When checking leak tightness, internal hydraulic testing with water (refer to Section 8.4.10) shall generally be carried out at a uniform pressure of 80 bar. Higher test pressures require prior agreement. The test pressure shall be limited so that the yield point at 20 °C will not be reached or exceeded (cf. DIN 2413 June 1972 edition Section 4.6). In the case of thin-walled large diameter tubes this will already have to be considered at pressures of 80 bar.

8.7 Re-testings

8.7.1 If one of the selected tubes fails to pass the tests according to Sections 8.6.2 (tensile test) and 8.6.3 (notch impact/bending test) and in the case of quality grade I tubes according to Section 8.6.5 (ring test) it shall be rejected, and two further tubes shall be taken from the batch and the tests repeated. In these new tests each tube must satisfy the requirements, otherwise the whole batch must be rejected.

8.7.2 If one specimen, taken at random, from a rolled lenght or part lehgth of quality grade III tubes of ≦51 mm outside diameter according to Section 8.4.6.2.1 fails in the ring check test, the test shall be repeated on the same end of the relevant rolled length or part length. If this replacement specimen proves unsatisfactory, the relevant rolled length or part length shall be rejected and the test repeated at one end of a further 20 % of the rolled lengths or part lengths of the batch. If another specimen fails again, the test will have to be extended to all rolled lengths or part lengths of the batch. Rolled lengths or part lengths which fail in the ring test shall be rejected.

[1] See page 1

[6] A proven, suitable non-destructive testing process can also be used instead of the visual inspection method.

If one ring test specimen [illegible] a rolled length or part length fails in single tests [illegible] quality grade III tubes according to Sections 8.4.6.2.2 and 8.4.6.2.3 the test shall be repeated on the same rolled length or part length. If this specimen also fails, the relevant rolled length or part length shall be rejected. On rejection of one rolled length it is left to the discretion of the manufacturer to ring test the corresponding part lengths.

8.7.3 If the unsatisfactory test results were due to unfavourable heat-treatment, it is at the discretion of the manufacturer's works to submit the rejected batch to further heat-treatment and re-submit it for acceptance. The manufacturer's works are entitled to remove the defects detected in the tests according to Sections 8.4.6 (ring test) 8.4.7 (non-destructive test) and 8.4.8 (visual inspection) by suitable means and to re-submit the tubes for acceptance.

8.8 Test certificates

8.8.1 • The acceptance test [1] shall be certified by an Acceptance Inspection Certificate A, B, or C, according to DIN 50 049, Section 3 (July 1972 edition).

Note: The certificates shall give the full wording of the identification marks, according to Section 9.1.

8.8.2 • If certificates require to be issued only for part of the requirements guaranteed by Acceptance Inspection Certificates A or C according to DIN 50 049, the manufacturer shall additionally confirm in an Inspection Certificate according to DIN 50 049 and for quality grade III tubes in an Acceptance Inspection Certificate B according to DIN 50 049, that the tube material corresponds in steel grade and steel quality to DIN 17 175, that all tubes have passed the leak tightness test and have an unobstructed bore, that they have been correctly annealed, or hardened and tempered over their entire lengths in a manner consistent with the tube material, and that quality grade III tubes have been manufactured from roughed-down squares or rounds, that an etch test or ultrasonic test was carried out, that the chemical composition was determined according to the ladle analysis and, if agreed at the time of ordering, also the steelmaking process be quoted. With tubes of quality grade III the carrying-out of an ultrasonic test has to be editionally stated in the Acceptance Inspection Certificate B according to DIN 50 049.

9 Identification of the tubes

9.1 The finished tubes shall be marked approximately 300 mm from the end.

The identification consists normally of a stamp mark. Another identification practice may be adopted for thin-walled tubes. The following identification marks shall be applied

on both ends:

material designation (Code No of grade of steel), for unalloyed steels the quality grade (unless quality grade I),

the trade mark stamp and

the inspectors stamp;

on one end:

the cast number or an identifying mark for the cast, applicable only for steels 15 Mo 3, 13 CrMo 4 4, 10 CrMo 9 10, 14 MoV 6 3 and X 20 CrMoV 12 1 for tubes of ≧159 mm outside diameter [7] In addition, the tube number for quality grade III tul

9.2 The stamp mark can be made more conspicuous according to Section 9.1 e.g. by a coloured line; the lines of the colour identification may be used for this.

10 Complaints

10.1 External and internal defects justify complaints, if they seriously affect the workability and serviceability of the type of steel and shape of the product.

10.2 The customer shall give the supplier an opportunity to prove [8] that the complaints were justified, preferably by submission of samples from the unsatisfactory material delivered.

[7] This limit applies also for tubes orders based on the inside diameter, provided the nominal outside diameter ≧159 mm.

[8] See also: Explanations to the "Complaints Clause" in Quality Standards for Iron and Steel. DIN-Mitt. 40 (1961), No 2, p. 111/112.

Further standards

DIN 2401 Part 1	Components under internal or external pressure; pressure and temperature data; definitions, nominal pressure ratings
DIN 8528 Part 1	Weldability; metallic materials, definitions

7.2.3 The tubes shall be supplied in the solution annealed condition over their full length in either:

— reference heat treatment conditions;

— solution annealed conditions obtained directly by extrusion and subsequent cooling provided the mechanical properties, corrosion resistance and other properties are in accordance with this part of EN 10216. All specified mechanical properties shall be met even after a subsequent reference heat treatment.

Solution treatment shall consist of heating the tubes uniformly to a temperature within the range given for the steel grade concerned in Tables 6, 7 and 8 and cooling rapidly.

7.2.4 The types of delivery condition of the tubes are given in Table 1.

Unless option 2 is specified, the type of delivery condition is at the discretion of the manufacturer.

Option 2: *The delivery condition is specified by the purchaser.*

Table 1 — Delivery conditions [a]

Symbol [b]	Type of delivery condition	Surface condition
HFD	Hot finished heat treated, descaled	Metallically clean
CFD	Cold finished heat treated, descaled	Metallically clean
CFA	Cold finished bright annealed	Metallically bright
CFG	Cold finished heat treated, ground	Metallically bright-ground, the type and degree of roughness shall be agreed at the time of enquiry and order [c]
CFP	Cold finished heat treated, polished	Metallically bright-polished, the type and degree of roughness shall be agreed at the time of enquiry and order [c]

[a] Combinations of the different conditions may be agreed at the time of enquiry and order.

[b] The symbols are abbreviations for type of condition. Example: CFD = Cold Finished Descaled.

[c] The enquiry and the order shall indicate whether the roughness requirement applies on the internal or external tube surface, or internal and external.

8 Requirements

8.1 General

When supplied in a delivery condition indicated in 7.2.4 and inspected in accordance with clauses 9, 10 and 11, the tubes shall conform to the requirements of this part of EN 10216.

In addition, the general technical delivery requirements specified in EN 10021 shall apply.

8.2 Chemical composition

8.2.1 Cast analysis

The cast analysis reported by the steel manufacturer shall apply and conform to the requirements of Tables 2 or 3 for austenitic steels and of Table 4 for austenitic-ferritic steels.

Option 3: *(see Table 2).*

UDC 621.643.2-462.3-034.14.018.8 DEUTSCHE NORM March 1981

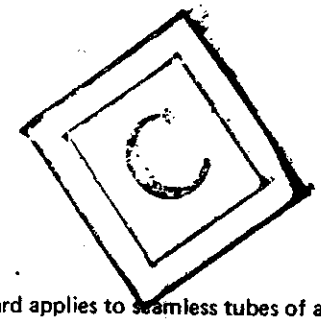
Seamless stainless steel tubes

Dimensions Masses per unit length

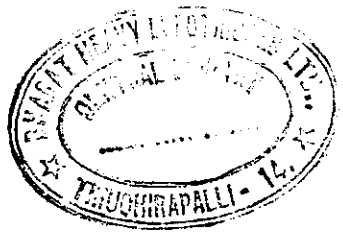
DIN 2462 Part 1

Nahtlose Rohre aus nichtrostenden Stählen; Masse, längenbezogene Massen

As it is current practice in standards published by the International Organization for Standardization (ISO), the comma has been used throughout as a decimal marker.



Dimensions in mm



1 Scope

This standard applies to seamless tubes of austenitic, ferritic and martensitic stainless steels according to DIN 17 440 in the selection according to DIN 2462 Part 2 [1] with tube outside diameters, wall thicknesses, masses (weights) per unit length and permissible deviations of dimension and form as decided for the revision of International Standard ISO 1127.

This standard does not apply to tubes for the beverage industry and for dairy machines; which are covered by DIN 11 850.

2 Other relevant standards

DIN 2462 Part 2 (Preliminary Standard) Seamless tubes of stainless steel; data for ordering and delivery.

3 Designation, order designation

Designation of a seamless tube of X 8 CrTi 17, material number 1.4510, finish h according to DIN 2462 Part 2, outside diameter 60,3 mm and wall thickness 2 mm:

Tube DIN 2462 – 1.4510 h – 60,3 x 2

or Tube DIN 2462 – X 8 CrTi 17 h – 60,3 x 2

The designation to be used on ordering for 1000 m of the above-quoted tube with tolerance classes D2, T3 according to table 2 thus reads as:

1000 m tube DIN 2462 – 1.4510 h – 60,3 – D2 T3

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1) Pending the appearance of complete technical delivery conditions, details regarding steel grades and conditions on delivery are to be taken from the preliminary Standard DIN 2462 Part 2.

Continued on pages 2 to 5
Explanations on page 5

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4 Dimensions, masses per unit length (weight)

4.1 For tube outside diameters, wall thicknesses and masses per unit length (weight) see tables 4 and 5.

In tables 4 and 5 the tube outside diameters are arranged in three series, in conformity with DIN ISO 4200, which are defined as follows:

Series 1:

Tubes with outside diameters for which all accessory items necessary for the construction of a pipeline, e.g. fittings for welding-in, flanges, flanged fittings, are standardized or are due to be standardized.

Series 2:

Tubes with outside diameters for which most, but not all, of the accessory items are standardized.

Series 3:

Tubes with outside diameters for special fields of application for the majority of which no standardized accessories are available; in the course of time one or the other of these diameters may be recommended for deletion.

The masses per unit length (weights) printed in bold type refer to tubes with outside diameters of series 1 in preferred thicknesses according to DIN ISO 4200, table 2.

The manufacturing possibilities for seamless tubes are indicated by the outer boundary line.

The dimensions enclosed within the stepped line for which no masses (weights) are stated are not usual commercial sizes (see table 4).

Larger sizes not contained in tables 4 and 5 may be ordered according to DIN 2448.

4.2 Lengths

The desired lengths must be agreed at the time of ordering.

The following are distinguished:

a) manufacturing lengths
The tubes are supplied in manufacturing lengths of 2 to 7 m; longer lengths must be agreed with the manufacturer.

b) fixed lengths
The specified size is observed within a tolerance ± 500 mm.

c) exact lengths

Table 1. Permissible deviations for exact lengths

For tubes with outside diameter $d_a \leq 40$ mm:	
up to and including 1 m tube length:	$^{+1}_{0}$ mm
over 1 m up to and including 2 m tube length:	$^{+2}_{0}$ mm
over 2 m up to and including 3 m tube length:	$^{+3}_{0}$ mm
over 3 m up to and including 4 m tube length:	$^{+4}_{0}$ mm
over 4 m up to and including 8 m tube length:	$^{+5}_{0}$ mm
For tubes with outside diameter $d_a > 40$ up to ≤ 168 mm:	
up to and including 6 m tube length:	$^{+5}_{0}$ mm
over 6 m tube length:	$^{+10}_{0}$ mm
For tubes with outside diameter $d_a > 168$ mm:	
all tube lengths:	$^{+10}_{0}$ mm

4.3 Permissible dimensional deviations

The permissible dimensional deviations for tube outside diameters and wall thicknesses depend on the tube manufacturing process, the steel grade and the aftertreatment method. The tolerances on tube outside diameter include out-of-roundness, whilst those on thickness include non-uniformity of thickness.

For ISO tolerance classes see ISO 5252 *)

Table 2 shows the correlation of the tolerance classes for tube outside diameter and wall thickness according to manufacturing method.

Table 2. **Permissible deviations of outside diameter and wall thickness**

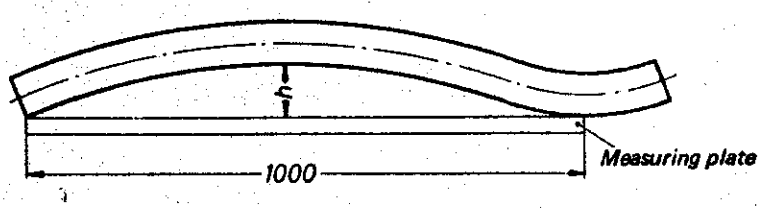
Scope		Outside diameter		Wall thickness	
Tube manufacturing process	Outside diameter d_a mm	ISO tolerance class	Permissible deviation	ISO tolerance class	Permissible deviation
cold-fabricated	$d_a \leqq 219{,}1$	D 2	± 1,0 % min. ± 0,5 mm	T 3	± 10 % min. ± 0,2 mm
		D 3 D 4	In special cases: ± 0,75 % min. ± 0,3 mm ± 0,5 % min. ± 0,1 mm	T 4	In special cases: ± 7,5 % min ± 0,15 mm
hot-fabricated	$44{,}5 \leqq d_a \leqq 219{,}1$	D 1	± 1,5 % min. ± 0,75 mm	T 1	± 15 % min. ± 0,6 mm
		D 2	In special cases: ± 1,0 % min. ± 0,5 mm	T 2	In special cases: ± 12,5 % min. ± 0,4 mm
	$219{,}1 < d_a \leqq 610$	D 1	± 1,5 % min. ± 0,75 mm 5)		+ 22,5 % / − 15 % 2)
				T 1	± 15 % min. ± 0,6 mm 3)
				T 2	± 12,5 % min. ± 0,15 mm 4)

2) Applies to tubes with wall thickness $s \leqq 0{,}05\, d_a$
3) Applies to tubes with wall thickness s: $0{,}05\, d_a < s \leqq 0{,}09\, d_a$
4) Applies to tubes with wall thickness $s > 0{,}09\, d_a$
5) The tubes can be ordered with sized ends. In this case a permissible deviation of the outside diameter of ± 0,6 % applies to the tube ends over a length of approx. 100 mm.

4.4 Permissible deviation from straightness

Table 3.

Tube outside diameter	Permissible deviation from straightness h
up to 17,2	–
over 17,2 up to 114,3	2
over 114,3	2,5



5 Material

Steel grades according to DIN 2462 Part 2 (Preliminary Standard)

6 Finish

According to DIN 2462 Part 2 (Preliminary Standard)

Unless agreed otherwise when ordering, the tubes will be supplied with metallically bright surface.

*) Obtainable through:
Deutsches Institut für Normung e.V., Burggrafenstrasse 4–10, 1000 Berlin 30.

Table 4. Dimensions and masses per unit length ...amless tubes of austenitic stainless steels

Tube outside diameter Series			Masses (weights) per unit length in kg/m for wall thicknesses of																			
1	2	3	1	1,2	1,6	2	2,3	2,6	2,9	3,2	3,6	4	4,5	5	5,6	6,3	7,1	8	8,8	10	11	12,5	14,2
	6		0,125	0,144																			
	8		0,176	0,204																			
	10		0,225	0,264																			
10,2			0,230	0,270	0,344	0,410																	
	12		0,275		0,416	0,500																	
13,5			0,313	0,369	0,477	0,576	0,645		0,769														
		14	0,326		0,496	0,601																	
	16		0,376	0,445	0,577	0,701																	
17,2			0,406		0,625	0,761	0,858			1,12													
		18	0,426		0,657	0,801																	
	19		0,451	0,535	0,697	0,851																	
	20		0,476	0,564	0,737	0,901		1,14															
21,3			0,509		0,789	0,966	1,10	1,22		1,45		1,74											
		22	0,526			1,00																	
	25		0,601	0,715	0,937	1,15		1,46		1,75													
		25,4		0,727	0,953	1,17		1,48															
26,9			0,649		1,01	1,25		1,58	1,75	1,90	2,10	2,29											
		30			1,14	1,40		1,79		2,14													
	31,8			0,920	1,21	1,49		1,90		2,29		2,78											
	32			0,926		1,50																	
33,7			0,818	0,976	1,29	1,58	1,81	2,02		2,45	2,71		3,29										
		35		1,02		1,65																	
	38			1,11	1,46	1,81		2,30		2,79													
	40			1,17	1,54			2,44															
42,4					1,63	2,02		2,59	2,86	3,14	3,49		4,27	4,68	5,16								
		44,5				2,13		2,73	3,02														
48,3					1,87	2,31	2,65	2,97		3,61	4,03			5,42		6,63							
	51		1,25	1,49	1,98	2,46		3,15		3,83													
		54			2,10	2,60		3,35															
	57				2,22	2,75			3,93														
60,3					2,35	2,92	3,34	3,76	4,17	4,58	5,11	5,63	6,28		7,66	8,52		10,5					
	63,5				2,48	3,08		3,96		4,83													
	70				2,74	3,40			4,87														
76,1					2,98	3,70	4,25	4,78	5,32		6,54	7,22		8,90			12,3	13,6		16,5			
		82,5				4,03				6,35													
88,9					3,49	4,35	4,98	5,61	6,24	6,86	7,68	8,51			11,7	13,0		16,2	17,7		21,4		
	101,6					4,98			7,17			9,77			13,5			18,8					
114,3								7,27	8,09		9,98		12,4			17,1	19,1		23,2		28,4		
139,7												13,6		16,8	18,8	21,0	23,5			32,5			
168,3																	28,6		35,1		43,3		
219,1																		42,2	46,3			54,7	
273																			58,2	66,9		81,5	92,0
323,9																				78,6		97,4	
355,6																					84,9	108	
406,4																							

Table 5. **Dimensions and masses per unit length of seamless tubes of ferritic and martensitic stainless steels**

Tube outside diameter Series			Masses (weights) per unit length in kg/m for wall thicknesses of											
1	2	3	1	1,2	1,6	2	2,3	2,6	2,9	3,2	3,6	4	4,5	5
	6		0,121	0,140										
	8		0,170	0,196										
	10		0,219	0,256										
10,2			0,224	0,262	0,334	0,398								
	12		0,267		0,404	0,486								
13,5			0,303	0,359	0,463	0,558	0,625		0,747					
		14	0,316		0,482	0,583								
	16		0,364	0,431	0,559	0,681								
17,2			0,394		0,607	0,739	0,832			1,08				
		18	0,413		0,637	0,777								
	19		0,437	0,519	0,677	0,825								
	20		0,462	0,548	0,715	0,875		1,10						
21,3			0,493		0,765	0,938		1,18		1,41		1,88		
		22	0,510			0,971								
	25		0,583	0,693	0,909	1,11		1,42		1,69				
		25,4		0,705	0,925	1,13		1,44						
26,9			0,629		0,983	1,21		1,54	1,69	1,84		2,23		
		30			1,10	1,36		1,73		2,08				
	31,8			0,892	1,17	1,45		1,84		2,23		2,70		
	32			0,897		1,46								
33,7			0,794	0,948	1,25	1,54	1,75	1,96		2,37			3,19	
		35		0,985		1,61								
	38			1,07	1,42	1,75		2,24		2,71				
	40			1,13	1,50			2,36						
42,4					1,59	1,96		2,51		3,04	3,39			4,54
		44,5				2,07		2,65	2,94					
48,3					1,81	2,25		2,89		3,51	3,91			5,26
	51		1,21	1,45	1,92	2,38		3,05		3,71				
		54			2,04	2,52		3,25						
	57				2,16	2,67			3,81					
60,3					2,29	2,84	3,24	3,64	4,05	4,44	4,95	5,47		
	63,5				2,40	2,98		3,84		4,69				
	70				2,66	3,30			4,73					
76,1					2,90	3,60	4,13	4,64	5,16		6,34	7,00		8,64
		82,5				3,91				6,17				
88,9					3,39	4,23	4,84	5,45	6,06	6,66	7,46	8,25		
	101,6					4,84			6,95			9,49		

Explanations

In the international standardization of steel tubes in ISO the practice which has been adopted since 1976 is no longer to determine the mass (weight) per unit length as the average of the metric and equivalent inch dimensions of the tubes, but instead to base them exclusively on the metric sizes. Following the changes in the values of the masses in ISO 1127 it became necessary also to revise the corresponding German Standards DIN 2462 and DIN 2463 to bring them into line with international practice. During this revision most of the other changes in the 2nd edition of ISO 1127 (15 March 1980) — particularly regarding the rationalization of standard tube dimensions — were also taken into account.

In this edition of DIN 2462 Part 1 the tube dimensions with masses per unit length and the arrangement of diameters in 3 series were taken over from ISO 1127 within the framework of manufacturing possibilities. Some extra tube sizes have also been included.

Where tube dimensions other than those listed in this standard are concerned, the sizes stated in DIN 2448 should be considered.

For tubes of austenitic stainless steels the masses per unit length are obtained by multiplying the masses quoted in DIN ISO 4200 by the factor 1,015. This factor is based on an average density of the steels of 7,97 kg/dm^3.

For calculating the mass per unit length of tubes of ferritic and martensitic stainless steels, the factor 0,985 was used; this is based on an average density of the steels of 7,73 kg/dm^3.

Table 5. **Guideline data for the heat treatment during fabrication and further processin / ubes and guideline data for hot working as part of further processing**

Steel grade		Heat treatment during fabrication and further processing		Solution annealing temperature [1]	
Symbol	Material number	Solution annealing temperature [1] °C	Quenching in	Temperature °C	Type of cooling
X 5 CrNi 18 10 X 2 CrNi 19 11 X 2 CrNiN 18 10	1.4301 1.4306 1.4311	1000 to 1080	Water, air [2]	1150 to 750	Air
X 6 CrNiTi 18 10 X 6 CrNiNb 18 10 X 5 CrNiMo 17 12 2 X 2 CrNiMo 17 13 2 X 6 CrNiMoTi 17 12 2 X 6 CrNiMoNb 17 12 2	1.4541 1.4550 1.4401 1.4404 1.4571 1.4580	1020 to 1100			
X 2 CrNiMoN 17 13 3	1.4429	1040 to 1120			
X 2 CrNiMo 18 14 3 X 5 CrNiMo 17 13 3	1.4435 1.4436	1020 to 1100			
X 2 CrNiMoN 17 13 5	1.4439	1040 to 1120			

[1] When heat treatment forms part of further processing of the product, an attempt shall be made to achieve the lower values of the range specified for solution annealing. If hot working has been carried out at a temperature of at least 850 °C or if the product has been cold worked, the temperature of renewed solution annealing may be 20 K less than the lower limit for solution annealing.

[2] If the cooling is sufficiently rapid.

Table 6. **Types of condition of tubes**

Symbol	Type of condition	Surface finish	Notes
c1	Hot worked, heat treated [1], descaled	Metallically clean	
c2	Hot worked, heat treated [1], pickled		
f	Mechanically or chemically descaled, cold worked, not heat treated	Metallically bright-drawn, much smoother than for conditions c1 and c2	Cold working without subsequent heat treatment modifies the properties depending on the degree of working; this applies in particular to austenitic steel tubes.
g	Cold worked, heat treated, not descaled	Scaled	Suitable only for components which will be descaled or worked.
h	Cold worked, heat treated and pickled	Metallically bright-pickled, smoother than for condition c2	
m	Cold worked and free from scale, heat treated	Metallically bright-annealed, smoother than for condition h	
n2	Cold redrawn (polished-drawn), bright heat treated	Metallically bright-annealed, smoother than for condition h or m	Especially suitable for grinding and polishing.
o	Ground	Metallically bright-ground; the type and degree of grinding shall be agreed at the time of ordering.	Conditions h, m or n2 are generally used as starting condition [2].
p	Polished	Metallically bright-polished; the quality and type of polishing shall be agreed at the time of ordering.	

[1] See also subclause 5.2.

[2] ● The order shall specify whether grinding or polishing is to be internal or external, or internal and external.

Table 7. **Summary of scope of t... programme and documents on materials testing**
(see figure 1 for sampling points and location of test pieces; see subclause 8.3.1 for batch size)

Testing			Scope of test programme		Responsibility for carrying out the tests	Type of documents on materials testing
No.	Type of test	As in subclause	Test class 1	Test class 2		
1	Cast analysis	5.3.1	Per cast or casting unit		Manufacturer	DIN 50049 – 2.2 [1]
2	Tensile test at ambient temperature	6.3.1.2 6.4.1 6.5.1	One test piece taken from one sample tube per batch [2]		By agreement	DIN 50049 – 3.1 A or DIN 50049 – 3.1 B or DIN 50049 – 3.1 C or DIN 50049 – 3.2 A or DIN 50049 – 3.2 C
3	Impact test	6.3.1.2 6.4.2 6.5.3	For wall thicknesses ≥ 20 mm 1 set of 3 individual test pieces per sample tube		By agreement	DIN 50049 – 3.1 A or DIN 50049 – 3.1 B or DIN 50049 – 3.1 C or DIN 50049 – 3.2 A or DIN 50049 – 3.2 C
4	Flattening test, ring expanding test (or drift expanding test) or ring tensile test (see table 8)	6.3.1.4 6.3.1.5.1 6.4.3 6.5.4 6.5.5 6.5.6 6.5.7	For wall thicknesses ≤ 40 mm 1 test piece from both ends of sample tube	1 test piece from one end of each tube or factory length [4]	By agreement	DIN 50049 – 3.1 A or DIN 50049 – 3.1 B or DIN 50049 – 3.1 C or DIN 50049 – 3.2 A or DIN 50049 – 3.2 C
5	Non-destructive testing of tube ends	6.3.1.5.2 6.5.12	For wall thicknesses > 40 mm –	All tubes	Manufacturer	DIN 50049 – 3.1 B
6	Leak tightness test	6.3.1.6 6.5.10	All tubes		Manufacturer	DIN 50049 – 2.1 [1]
7	Visual examination	6.3.1.6 6.5.11	All tubes		By agreement	DIN 50049 – 3.1 A or DIN 50049 – 3.1 B or DIN 50049 – 3.1 C or DIN 50049 – 3.2 A or DIN 50049 – 3.2 C
8	Materials identity test	6.3.1.6 6.5.17	All tubes		Manufacturer	DIN 50049 – 2.1 [1]
9	Check on dimensions	6.3.1.6 6.5.15 6.5.16	All tubes		By agreement	DIN 50049 – 3.1 A or DIN 50049 – 3.1 B or DIN 50049 – 3.1 C or DIN 50049 – 3.2 A or DIN 50049 – 3.2 C
10	Non-destructive testing of tube wall	6.3.1.5.3 6.3.1.7 6.5.13	By agreement	All tubes [3]	Manufacturer	DIN 50049 – 3.1 B
11	Hot tensile test [6]	6.3.1.3 6.5.2	By agreement		By agreement	DIN 50049 – 3.1 A or DIN 50049 – 3.1 B or DIN 50049 – 3.1 C or DIN 50049 – 3.2 A or DIN 50049 – 3.2 C
12	Product analysis [6]	5.3.2 6.3.1.9 6.4.4 6.5.8	1 product analysis per cast		Manufacturer	DIN 50049 – 3.1 B
13	Testing for intercrystalline corrosion [6]	5.7.2 6.3.1.8 6.5.9	By agreement		Manufacturer	DIN 50049 – 3.1 B

[1] This certificate may also be included in the next higher stage of document.

[2] In the case of tubes with d_a not less than 200 mm or a wall thickness not less than 12 mm, which are to be used for pressure vessel casings, testing shall cover 10 % of the test batch

[3] In the case of tubes to be used for pressure vessel casings, testing shall cover 10 % of the test batch.

[4] In the case of tubes which are to be used for pressure vessel casings and which are to be subjected to ultrasonic examination as specified in *Stahl-Eisen-Prüfblättern* 1915 and 1918, the scope of testing ring test pieces shall be reduced to 10 % of the test batch.

[5] Only subject to agreement at the time of ordering in the case of tubes with an outside diameter not exceeding 101,6 mm and a wall thickness not exceeding 5,6 mm (see subclause 6.3.1.7).

[6] Only subject to agreement between manufacturer and purchaser.

(TO BE STAMPED IN ACCORDANCE WITH STAMP ACT)

429-011

PERFORMANCE BANK GUARANTEE

In accordance of M/s. Bharat Heavy Electricals Limited (A Government of India Undertaking, a company incorporated under the Companies Act. 1956 having its Registered Office at "BHEL House" SHRI Fort, New Delhi 110 049") through its Tiruchirappalli Division (hereinafter called the Company) having agreed to exempt _____ hereinafter called the said contractor which term includes 'suppliers' for the purpose of this Bond) from the demand under the terms and conditions of the Agreement dt_____ made between _____ and _____ for _____ (hereinafter called the said agreement) for Security Deposit for the due fulfilment by the said Contractor of the terms and conditions contained in the said Agreement on production of a Bank Guarantee for Rs. _____ (Rupees_____ _____ only). We (indicate the name of the Bank), (hereinafter referred to as the Bank) at the request of _____ (Contractor/s) do hereby undertake to pay to the company an amount not exceeding Rs._____ against any loss or damage caused to or suffered or would be caused to or suffered by the Company by reason of any breach by the said Contractor (s) of any of the terms and conditions contained in the said Agreement.

2. We, (Indicate the name of the bank with full address), do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the Company stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the Company by reason of breach by the said Contractor (s) of any of the terms and conditions contained in the said Agreement or by the reason of the contractor(s) 'failure to perform' the said Agreement. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs._____

3. We undertake to pay unconditionally to the Company any money so demanded notwithstanding any dispute(s) raised by the contractor in any suit, or proceedings pending before any Court or Tribunal or Arbitration or before any other authority relating thereto our liability under this present being absolute and unequivocal.

The payment so made by us under this Bond shall be a valid discharge of liability for payment thereunder and the Contractor(s) shall have no claim against us for making such payment. The payment under this guarantee would not wait till the disputes have been decided by any Court or Tribunal or in the arbitration proceedings or by any other authority.

4. We, (indicate the name of Bank), further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all the dues of the Company under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharge or till _____ office / Department / Division of the Company certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said Contractor (s) and accordingly discharges this guarantee.

5. (i) Unless a demand or claim under this guarantee is made on us in writing on or before the _____ we shall be discharged from all the liability under this guarantee thereafter. But where such claim or demand has been preferred by the Company with the Bank before the expiry of the said date the claim shall be enforceable not withstanding the fact that the said enforcement is effected after the said date.

(ii) For the purpose of this clause, any letter making demand on the Bank by M/s. BHEL despatched by Registered Post with Ack. Due or by telegram addressed to the above mentioned address of the Bank shall be deemed to be the claim deemed in writing referred to above irrespective of the fact as to whether and when the said letter reaches the Bank, as also any letter containing the said demand or claim is lodged with the Bank personally.

6. We, (indicate the name of Bank), further agree with the Company that the company shall have the fullest liberty without our consent and without affecting in any manner our obligation hereunder to vary any of the terms and conditions of the said Agreement or to extent time of performance by the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers execisable by the Company against the said Contrctor(s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by any reason of any such variation or extension being granted to the said Contractor(s) or for any forbearance, act or omission on the part of the company or any indulgence by the company to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to surities would but for this provision have effect of so relieving us.

7. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

8. It shall not be necessary for the company to proceed against the contractor before proceeding against the guarantor bank and the guarantee herein contained shall be enforceable against them notwithstanding any security, which the company may have obtained or obtain from the Contractor shall, at the time when proceedings are taken against the guarantor hereunder be outstanding or unrealised.

9. Any claim or dispute arising under the terms of this document shall only be enforced or settled in the Courts at Tiruchirapalli.

10. The guarantor hereby declare that it has power to execute this guarantee and the executant has full power to do so on its behalf under the Power of Attorney dated _____ granted to him by the proper authorities of the guarantor.

11. We (indicate the name of Bank) lastly undertake not to revoke the guarantee during its currancy except with the previous consent of the company in writing.

In witness whereof we, (indicate the name of Bank) have hereunto setout our Bank Seal the _____ day _____ month

List of Consortium Bank			
	Nationalised Bank		**Nationalised Bank**
1	Allahabad bank	18	United Bank of India
2	Andhra bank	19	Vijaya Bank
3	Bank of Baroda		**Public Sector Banks**
4	Bank of India	20	IDBI
5	Canara Bank		**Foreign bank**
6	Corporation bank	21	CITI Bank N.A
7	Central bank	22	Deutsche Bank AG
8	Indian Bank	23	The Hongkong and Shanghai Banking Corporation Limited
9	Oriental bank of Commerce	24	Standard Chartered Bank
10	Punjab National Bank	25	The Royal Bank of Scotland N.V.
11	Punjab & Sindh Bank		**Private bank**
12	State Bank of India	26	Axis Bank
13	State Bank of Hyderabad	27	The Federal Bank Limited
14	Syndicate Bank	28	HDFC
15	State Bank of Travancore	29	Kotak Mahindra Bank
16	UCO Bank	30	ICICI
17	Union Bank of India	31	Indusind Bank