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	Phone: **+91 431 2577378/2575078** Fax : **+91 431 252 07 19** Email : **mahadev@bheltry.co.in**

	Reference Number: Enquiry 1501000106	**Enquiry Date: 20.09.2010**	**Due date for submission of quotation: 11.11.2010**
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 A. Kindly note that

1. Material supply/sourcing in any form from Chinese suppliers is not acceptable.

2. Only vendors with prior experience of supply to Nuclear Power Corporation of India Ltd or any other nuclear power station are asked to submit their offers.

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 "**1501000106** "

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** DGM/ PURCHASE / MM / MFG

BHARAT HEAVY ELECTRICALS LIMITED

ENQUIRY

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

PHONE :2577378
GRAMS : BHARATELEC
FAX NO: 2520719
E-mail: mahadev@bheltry.co.in
Web:

Enquiry No	Enquiry Date	Due Date for Quotation
1501000106	20.09.2010	11.11.2010

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 5000lg- 85No 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 to be supplied in random length of 4 to 8 meters and accounting for over all length of. (or) SA335GRP1 meeting UT and hydro test requirement.	M	425.000	425.00	19.02.11
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	19.02.11

General Note:

1)The tender will be opened on 'TWO PART BASIS". Vendors has to submit offers in TWO separate Covers (i) One cover duly super scribed as "Technical / Commercial Offer' and (ii) another cover as "Price Bid"
2)The covers should be duly super scribed with the ENQUIRY NO in BOLD letter without fail.
3)Both the Technical / Commercial and Price Bid are to be submitted before 2.00 P.M on 11.11.2010
4)The date of opening of price bid will be informed later after acceptance of offer on technical ground.
5)The length tubes are to be supplied as per the description mentioned.If any variation in length may please be mentioned in the offer it self.
6)For IMPORT -Inspection by lloyds / any authorized third party as prescribed by BHEL at the time of ordering.
7)Offer should indicate the name of the inspection agency.
8) All rates should include the third party inspection charges. Rates quoted should be inclusive of all charges like packing charges and inspection charges. The prices are to be quoted in per meter basis.
9)Import supplies to quote both on FOB and CFR Chennai basis, with break-up freight details for IMPORTS.The rates shall be of inclusive of

The offers should reach us 30 minutes before the time of opening of tenders.
The offers will be opened at 14.30 hrs on the due date of tender in the presence of tenderers who have submitted their offer and who may like to be present for the tender opening.Late and delayed offers are liable to be rejected.

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

MANAGER / PURCHASE
(FOSSIL BOILERS)

BHARAT HEAVY ELECTRICALS LIMITED

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1501000106 / 20.09.2010

any third party inspection as called for.
10) The actual production of tube materials is permitted only after review/approval of manufacturing/testing/ Inspection drawings /documents and quality assurance plans (QAP) by BHEL, Tiruchy.
11) Five sets additional dialets containing test certificates, copies of the approved procedures DCR, Drgs etc apart from contractual requirements are required.
12)Material sourcing in any form from Chinese sources is not acceptable.
13) Confirmation for partial ordering to be indicated in the offer itself.
14)BHEL reserves the right to order as a whole or individual item depending upon the requirement of BHEL
15)Offers should be kept valid for minimum 45 days. Extension if required will be requested.
16)We require all these tubes are to be supplied positively before February 2011.
17)Vendors should indicate confirmation of specific specification point by point as applicable to the tender. Only Deviation if any with respect to specific clause alone should be clearly spelt out in the offer.
18)The supplies are to be made according to the specifications as mentioned against individual serial nos.
a)DIN 17175
b)DIN 17458
c)DIN 2462
d)PB-M-96
19)Supplier should have supplied atleast one set to Nuclear Power Corporation of India Limited or any other Nuclear Power Station. Also the supplier has to furnish the test certificate for the similar finished tubes, along with the detailed reference list with name and address of the customer to whom the material is supplied.
20)Offers will be evaluated on the basis of financial lowest status, considering both the items together as a whole.

Enclosures:

"LD clause has to be confirmed without fail."

The offers should reach us 30 minutes before the time of opening of tenders.
The offers will be opened at 14.30 hrs on the due date of tender in the presence of tenderers who have submitted their offer and who may like to be present for the tender opening.Late and delayed offers are liable to be rejected.

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

MANAGER / PURCHASE
(FOSSIL BOILERS)
Yours faithfully,

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).

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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

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.

UDC 621.643.2-462.3-034.14.018.8 DEUTSCHE NORM March 1981

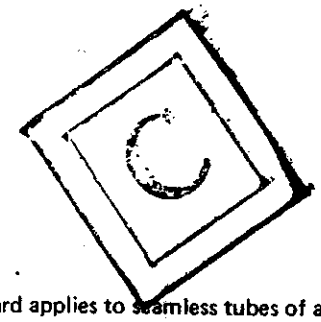
Seamless stainless steel tubes

Dimensions Masses per unit length

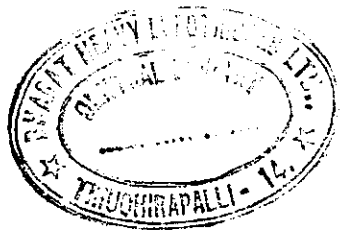
DIN 2462 Part 1

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**

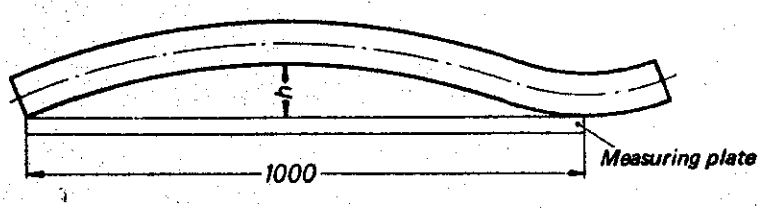
Scope		Outside diameter		Wall thickness	
Tube manufacturing process	Outside diameter d_a mm	ISO tolerance class	Permissible deviation	ISO tolerance class	Permissible deviation
cold-fabricated	$d_a \leqq 219{,}1$	D 2	± 1,0 % min. ± 0,5 mm	T 3	± 10 % min. ± 0,2 mm
		D 3 D 4	In special cases: ± 0,75 % min. ± 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.