

JIS G3458 Alloy Steel Pipes

1. Scope

This Japanese Industrial Standard specifies the alloy steel pipes, hereinafter referred to as the "pipes", mainly used form high temperature service.

Remarks

1. When previously agreed upon by the manufacturer, the purchaser may designate part or all of the supplementary quality requirements Z 2, Z 3 and Z 4 specified in Appendix, in addition to the items specified in this text.

Appendix Z 2 Elevated Temperature Yield Point or Proof Stress

Appendix Z 3 Ultrasonic Examination

Appendix Z 4 Eddy current Examination

2. The units and numerical values given in { } in this Standard are based on the International System of Units (SI) and are appended for informative reference.

Further, the traditional units accompanied by numerical values in this Standard shall be converted to the SI and numerical values on Jan. 1, 1991.

2. Grade and designation

The pipe shall be classified into seven grades and their letter symbols shall be as given in Table 1.

Table 1. Letter Symbol of Grade

| Letter Symbol of Grade | |
|--------------------------------|---------|
| Molybdenum steel pipe | STPA 12 |
| Chromium-molybdenum steel pipe | STPA 20 |
| | STPA 22 |
| | STPA 23 |
| | STPA 24 |
| | STPA 25 |
| | STPA 26 |

World standard Conferens Table

| KS | | ASTM | | JIS | | DIN | | BS | |
|--------------|--------|--------------|-------|--------------|--------|--------------|-------|--------------|-------|
| Grade number | GRADE | Grade number | GRADE | Grade number | GRADE | Grade number | GRADE | Grade number | GRADE |
| D 3573 | SPA 12 | A335 | P 1 | G-3458 | STPA12 | 17175 | 15Mo3 | - | - |

| | | | | | | | | | |
|--|--------|--|------|--|--------|-------|------------|------|--|
| | SPA 20 | | P 2 | | STPA20 | - | - | | HFS660 CFS660 ERW660 CEW660 |
| | SPA 22 | | P 12 | | STPA22 | 17175 | 13Cr Mo44 | 3604 | HFS620-460 620-440 CFS620-460 620-440 ERW620-460 620-440 CEW620-460 620-440 |
| | SPA 23 | | P 11 | | STPA23 | - | - | | HFS621 CFS621 ERW621 CEW621 |
| | SPA 24 | | P 22 | | STPA24 | 17175 | 10Cr Mo910 | | HFS622 CFS622 |
| | SPA 25 | | P 5 | | STPA25 | - | - | | HFS625 CFS625 |
| | SPA 26 | | P 9 | | STPA26 | - | - | - | - |
| | | | P 5b | | | | | | |
| | | | P 5c | | | | | | |
| | | | P 15 | | | | | | |
| | | | P 91 | | | | | | |

3. Method of Manufacture

3.1 The pipe manufacture shall be as follows.

3.2 The pipe shall be subjected to the heat treatment specified in Table 2. The heat treatment not specified in Table 2 shall be agreed upon by the purchaser and the

manufacturer.

Table 2

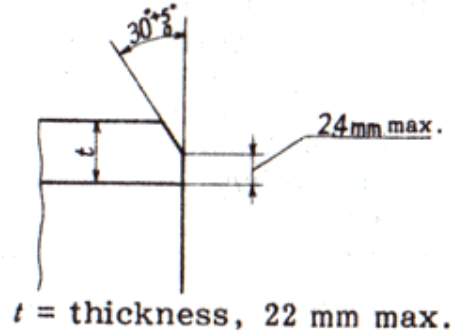
| Letter symbol of grade | Heat treatment |
|------------------------|--|
| STPA 12 | Low temperature annealing isothermal annealing, full annealing, normalizing full annealing, normalizing or normalizing followed by tempering |
| STPA 20 | |
| STPA 22 | |
| STPA 23 | Low temperature annealing, isothermal annealing, full annealing or normalizing followed by tempering |
| STPA 24 | |
| STPA 25 | Isothermal annealing, full annealing or normalizing followed by tempering |
| STPA 26 | |

Remark.

The tempering temperature for grade STPA23, STPA24, STPA25 and STPA26 shall be 650n or higher.

3.3 When required by the purchaser, the pipe may be furnished with the bevel end(1)

(1) Unless otherwise specified, the shape of the bevel end shall be as shown in Fig. 1.



4. Chemical Composition

The pipe shall be tested in accordance with 9.1 and the resulting ladle analysis values shall conform to Table 3 .

Table 3

| Letter symbol of grade | Chemical Composition % | | | | | | |
|------------------------|------------------------|-----------|-----------|------------|------------|------------|-----------|
| | C | Si | Mn | P | S | Cr | Mo |
| STPA 12 | 0.10~0.20 | 0.10~0.50 | 0.30~0.80 | 0.035 max. | 0.035 max. | - | 0.45~0.65 |
| STPA 20 | 0.10~0.20 | 0.10~0.50 | 0.30~0.60 | 0.035 max. | 0.035 max. | 0.50~0.80 | 0.45~0.65 |
| STPA 22 | 0.15max. | 0.50 max. | 0.30~0.60 | 0.035 max. | 0.035 max. | 0.80~1.25 | 0.45~0.65 |
| STPA 23 | 0.15max. | 0.50~1.00 | 0.30~0.60 | 0.030 max. | 0.030 max. | 1.00~1.50 | 0.45~0.65 |
| STPA 24 | 0.15max. | 0.50 max. | 0.30~0.60 | 0.030 max. | 0.030 max. | 1.90~2.60 | 0.87~1.13 |
| STPA 25 | 0.15max. | 0.50 max. | 0.30~0.60 | 0.030 max. | 0.030 max. | 4.00~6.00 | 0.45~0.65 |
| STPA 26 | 0.15max. | 0.25~1.00 | 0.30~0.60 | 0.030 max. | 0.030 max. | 8.00~10.00 | 0.90~1.10 |

Remarks

When product analysis is required by the purchaser, the values of chemical composition given in the above table shall be applied.

5. Mechanical Properties

5.1 Tensile Strength, Yield Point or Proof Stress and Elongation

The pipe shall be tested in accordance with 9.2 and the resulting tensile strength, yield point or proof stress and elongation shall comply with Table 4.

Table 4 Mechanical Properties

| Letter symbol of grade | | | | | | |
|------------------------|--|--|----------------------------|------------|------------------|------------|
| | Tensile strength | Yield point or proof stress | Elongation % | | | |
| | kgf/mm ² {N/mm ² } | kgf/mm ² {N/mm ² } | No. 11 or No.12 test piece | | No. 4 test piece | |
| | | | Longitudinal | Transverse | Longitudinal | Transverse |
| STPA 12 | 39{382}min. | 21{206} min. | 30 min. | 25 min. | 24 min. | 19 min. |
| STPA 20 | 42{412}min. | 21{206} min. | 30 min. | 25 min. | 24 min. | 19 min. |
| STPA 22 | 42{412}min. | 21{206} min. | 30 min. | 25 min. | 24 min. | 19 min. |
| STPA 23 | 42{412}min. | 21{206} min. | 30 min. | 25 min. | 24 min. | 19 min. |
| STPA 24 | 42{412}min. | 21{206} min. | 30 min. | 25 min. | 24 min. | 19 min. |
| STPA 25 | 42{412}min. | 21{206} min. | 30 min. | 25 min. | 24 min. | 19 min. |
| STPA 26 | 42{412}min. | 21{206} min. | 30 min. | 25 min. | 24 min. | 19 min. |

Remarks

1. When tensile test is carried out on No. 12 or No. 5 test piece for the pipe under 8mm in wall thickness, the minimum value of elongation shall be calculated by subtracting 1.5 % from the values of elongation given in Table 4 for each 1mm decrease in wall thickness, and rounding off to an integer in accordance with JIS Z 8401. Examples of calculation are given in Reference Table.
2. The value of elongation given in Table 4 shall not be applied to the pipe whose outside diameter is under 40mm. However, the value of elongation shall be recorded.

Reference Table Calculation Examples of Elongation Applied to No. 12 (longitudinal) and No. 5 (Transverse) Test Pieces for pipe under 8mm in Wall Thickness

| Letter symbol of grade | Shape of test piece | Elongation value relating to wall thickness % | | | | | | |
|------------------------|---------------------|---|-------------------------------|-------------------------------|-------------------------------|-------------------------------|------------------------------|-------------------------------|
| | | Over 7mm, up to 8mm | Over 6mm, up to and incl. 7mm | Over 5mm, up to and incl. 6mm | Over 4mm, up to and incl. 5mm | Over 3mm, up to and incl. 4mm | Over 2mm up to and incl. 3mm | Over 1mm, up to and incl. 2mm |
| All grade | No.12 test piece | 30 | 28 | 27 | 26 | 24 | 22 | 21 |
| | No.5 test piece | 25 | 24 | 22 | 20 | 19 | 18 | 16 |

5.2 Flattening Resistance The pipe shall be tested in accordance with 9.3 and the pipe shall be free from flaws or cracks on its wall surfaces. The distance between the flattening plates in this test shall be in accordance with the following formula.

$$H = \frac{(1 + e)t}{e + \frac{t}{D}}$$

Where H : distance between flattening plates(mm)

t : wall thickness of pipe(mm)

D : outside diameter of pipe(mm)

e : constant, 0.08

6. Hydrostatic Characteristic or Nondestructive Characteristic

The pipe shall be tested in accordance with 9.4 and the resulting hydrostatic characteristic or nondestructive characteristic shall conform to either of the following two. The preference shall be in accordance with the designation made by the purchaser or left to the discretion of the manufacturer.

6.1 Hydrostatic Characteristic (Applicable till the end of 1990)

When the hydrostatic pressure specified by the purchaser or, unless otherwise specified, the values given in Attached Table 1 is applied, the pipe shall withstand it without leakage.

In this case, the purchaser may specify values of pressure lower or higher than those given in Attached Table 1.

When a hydrostatic pressure test is made in compliance with the designation of the purchaser and the test pressure exceeds either 200 kgf/cm² {196 bar} or the value P calculated from the following formula, the test pressure shall be agreed upon by the purchaser and the manufacturer. The designated hydrostatic test pressure shall be graduated in 5 kgf/cm² {4.9 bar}.

The value P in the following formula shall be obtained by computing to the unit digit and rounding off to the nearest 5 kgf/cm² {4.9 bar}.

$$P = 200st / D$$

Where

P: test pressure [kgf/cm²{10⁻¹bar⁽²⁾}]

t: wall thickness of pipe (mm)

D: outside diameter of pipe(mm)

s: 60 % of the minimum value of yield point or proof stress specified in Table 3 (kgf/mm²{N/mm²})

Note (2) 1bar = 10⁵Pa

6.2 Nondestructive Characteristic

Either radiographic or ultrasonic examination or an eddy current examination shall be made on the pipe, and there shall be no signal greater than those produced by the artificial defects of the reference test block which is the division UD of the working sensitivity specified in JIS G 0582 or the division EY of the working sensitivity specified in JIS G 0583, respectively.

7. Appearance

7.1 The pipe shall be practically straight, and its both ends shall be at right angles to its axis.

7.2 The inside and outside surfaces of the pipe shall be well-finished and free from defects detrimental to practical use.

8. Dimensions, Mass and Dimensional Tolerances

8.1 Dimensions and Mass

The outside diameter, wall thickness and mass of the pipe shall be as specified in Attached Table 2.

8.2 Dimensional Tolerances

The tolerances on outside diameter, wall thickness and deviation in wall thickness of the pipe shall be as specified in Table 5.

Further, in the case where the pipe length is specified, the tolerances shall be on the plus side.

Table 5 Tolerances on Outside Diameter, Wall Thickness and Deviation in Wall Thickness

| Division | Tolerances on outside diameter | Tolerances on wall thickness | Tolerance on deviation in wall thickness |
|----------------------------------|---|---|--|
| Hot finished seamless steel pipe | Up to 50mm 【0.5mm | ≤Up to 4mm 【0.5mm ≤4mm and over 【12.5% | Up to and incl. 20% of wall thickness |
| | 50mm and over, up to 160mm 【1% | | |
| | 160mm and over, up to 200mm 【1.6mm | | |
| | 200mm and over 【0.8 % | | |
| | However, for pipes 350mm and over in diameter, the length of circumference may substitute as a basis for the tolerances. In this case, the tolerances shall be 【0.5%. | | |

| | | | |
|-----------------------------------|---|--|--|
| Cold finished seamless steel pipe | Up to 40mm 【0.4mm | ≤Up to 2mm 【 0.2mm ≤2mm and over 【10% | |
| | 40mm and over 【0.8% However, for pipes 350mm and over in diameter, the length of circumference may substitute as a basis for tolerances. In this case, the tolerances shall be 【0.5% | | |

Remarks

1. The deviation in wall thickness means the ratio of the difference between the maximum and the minimum of the measured thickness of a wall in the same section to the specified wall thickness. This shall not be applied to pipes under 5.6mm in wall thickness.
2. When the length of circumference is used as a basis for the tolerances, either the measured value of the length of circumference itself or the outside diameter derived from the measured value may be used as the criteria. In both cases, the same value 【 0.5 % shall be applied as the tolerances. The diameter (D) and the length of circumference (l) shall be calculated reversibly from the following formula.

$$l = \pi \cdot D \quad \text{Where } \pi = 3.1416$$

3. In the case where compliance with the tolerances on wall thickness in the above table is clearly confirmed in such a local portion as under repairs, the tolerances on the outside diameter in the above table shall not be applied.

9. Test

9.1 Chemical Analysis

9.1.1 Chemical Analysis

General matters of chemical analysis and method of sampling specimens for analysis shall be in accordance with 3. in JIS G 0303.

9.1.2 Analytical The analytical method shall be in accordance with one of the following Standards.

JIS G 1217

JIS G 1253

JIS G 1256

JIS G 1257

JIS G 1214

JIS G 1215

JIS G 1211

JIS G 1212

JIS G 1213

JIS G 1218

9.2 Tensile Test

9.2.1 Test Piece

The test specimen shall be No. 11, No. 12 A, No. 12 B, No. 12 C, No. 4 or No. 5 test piece specified in JIS Z 2201 and shall be cut off from the end of a pipe. In this case, the gauge length for No.4 test piece shall be 50mm

9.2.2 Test Method

The test method shall be in accordance with JIS Z 2241.

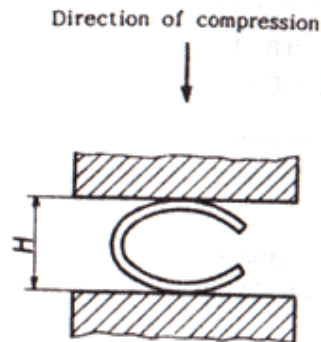
9.3 Flattening Test

9.3.1 Test Piece

A test piece 50mm or over in length shall be cut off from the end of a pipe. For the pipe whose wall thickness is 15 % or over of its outside diameter, C-shape test piece made by removing part of circumference of a whole test piece may be used.

9.3.2 Test Method

The test piece shall be placed between two flat plates and flattened by compression in ordinary temperature until the distance between the plates comes to the specified value, and checked for the occurrence of flaws or crack on its wall surface. The C-shape test piece, however, shall be placed as shown in Fig. 2.



9.4 Hydrostatic Test or Nondestructive Examination

Either the hydrostatic test or the nondestructive examination shall be made in accordance with 9.4.1 or 9.4.2, respectively.

9.4.1 The pipe shall be subjected to hydrostatic-pressure and kept at the specified pressure to see if it withstands the pressure without leakage.

9.4.2 The test method of nondestructive examination shall be in accordance with either JIS G 0592 or JIS G 0583.

10. Inspection

10.1 General matters of inspection shall be as specified in JIS G 0303.

10.2 The chemical composition, mechanical properties, hydrostatic or nondestructive characteristic, dimensions and appearance shall conform to 3., 4., 5., 6. and 7. However, appropriate nondestructive examinations other than those specified in 9.4 (2) may substitute for the said nondestructive examination when agreed upon by the purchaser and the manufacturer.

Further, when the supplementary quality requirements given in Appendix are specified by agreement between the purchaser and the manufacturer, the results of inspection shall conform to the relevant requirements specified in Z 2, Z 3 and Z 4.

10.3 Either the hydrostatic test or the nondestructive examination shall be performed for each pipe.

10.4 The number of specimens for the product analysis shall be agreed upon by the purchaser and the manufacturer.

10.5 The method of sampling test specimens and the number of test pieces for tensile test and flattening test shall be as follows. Take one pipe as the specimen from each 50 pipes or its fraction which are subjected to a concurrent heat treatment, and then from the test specimen take one tensile test piece and one flattening test piece.

11. Reinspection

The pipe may be retested in accordance with 4.4 in JIS G 0303 for final acceptance.

12. Marking

Each pipe has passed the inspection shall be marked with the following items. However, in the case of either smaller pipes or a request from the purchaser, the pipes may be bundled together and marked for each bundle by suitable means. In both cases, the order of arranging the items is not specified.

When approved by the purchaser, part of the items may be omitted.

- (1) Letter symbol of grade
- (2) Letter symbol indicating the manufacturing process ⁽³⁾
- (3) Dimensions ⁽⁴⁾
- (4) Manufacturer's name or its abbreviation
- (5) Letter symbol denoting the supplementary quality requirement, Z

Notes ⁽³⁾

The letter symbol denoting the manufacturing process shall be as follows. The dash may be replaced by a blank.

Hot finished seamless steel pipe: -S-H

Cold finished seamless steel pipe: -S-C

Notes ⁽⁴⁾

The dimensions shall be expressed as follows.

Nominal diameter X nominal wall thickness or
outside diameter X wall thickness

Example: 50A × 40

13. Report

The manufacturer shall, as a rule, submit to the purchaser the report on the test results, method of manufacturing conditions, etc.

Attached Table 1 Hydrostatic Test Pressure Unit: kgf/P{bar}

| | | | | | | | | | | |
|---------------------------|------------|------------|------------|------------|------------|--------------|--------------|--------------|--------------|--------------|
| Schedule number Sch | 10 | 20 | 30 | 40 | 60 | 80 | 100 | 120 | 140 | 160 |
| Hydrostatic test pressure | 20 {20} | 35 {34} | 50 {49} | 60 {59} | 90 {88} | 120 {118} | 150 {147} | 180 {176} | 200 {196} | 200 {196} |

Remark

For the pipe whose dimension is not given in Attached Table 2, the hydrostatic test pressure shall conform to the following table depending on the division of the ratio of the wall thickness to outside diameter of the pipe (t / D).

| t / D % | Over 0.80, up to and incl. 1.60 | Over 1.60, up to and incl. 2.40 | Over 2.40, up to and incl. 3.20 | Over 3.20, up to and incl. 4.00 | Over 4.00, up to and incl. 4.80 | Over 4.80, up to and incl. 5.60 | Over 5.60, up to and incl. 6.30 | Over 6.30 up to and incl. 7.10 | Over 7.10 up to and incl. 7.90 | Over 7.90 |
|--------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|--------------------------------|--------------------------------|-----------|
| Hydrostatic test pressure kgf/P{bar} | 20 {20} | 40 {39} | 60 {59} | 80 {79} | 100 {98} | 120 {118} | 140 {137} | 160 {157} | 180 {176} | 200 {196} |

Attached Table 2. Dimensions and Mass for Alloy Steel Pipes

| Nominal dia. | | Outside dia. mm | Nominal wall thickness | | | | | | | | | | | | | | | | | | | | |
|--------------|-------|-----------------|------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------|
| A | B | | Schedule 10 | | Schedule 20 | | Schedule 30 | | Schedule 40 | | Schedule 60 | | Schedule 80 | | Schedule 100 | | Schedule 120 | | Schedule 140 | | Schedule 160 | | |
| | | | Wall thick. mm | Unit mass kg/m | Wall thick. mm | Unit mass kg/m | Wall thick. mm | Unit mass kg/m | Wall thick. mm | Unit mass kg/m | Wall thick. mm | Unit mass kg/m | Wall thick. mm | Unit mass kg/m | Wall thick. mm | Unit mass kg/m | Wall thick. mm | Unit mass kg/m | Wall thick. mm | Unit mass kg/m | Wall thick. mm | Unit mass kg/m | |
| 6 | 1/8 | 10.5 | - | - | - | - | - | - | 1.7 | 0.369 | - | - | 2.4 | 0.479 | - | - | - | - | - | - | - | - | |
| 8 | 1/4 | 13.8 | - | - | - | - | - | - | 2.2 | 0.629 | - | - | 3.0 | 0.799 | - | - | - | - | - | - | - | - | |
| 10 | 3/8 | 17.3 | - | - | - | - | - | - | 2.3 | 0.851 | - | - | 3.2 | 1.11 | - | - | - | - | - | - | - | - | |
| 15 | 1/2 | 21.7 | - | - | - | - | - | - | 2.8 | 1.31 | - | - | 3.7 | 1.64 | - | - | - | - | - | - | - | 4.7 | 1.97 |
| 20 | 3/4 | 27.2 | - | - | - | - | - | - | 2.9 | 1.74 | - | - | 3.9 | 2.24 | - | - | - | - | - | - | - | 5.5 | 2.94 |
| 25 | 1 | 34.0 | - | - | - | - | - | - | 3.4 | 2.57 | - | - | 4.5 | 3.27 | - | - | - | - | - | - | - | 6.4 | 4.36 |
| 32 | 1 1/4 | 42.7 | - | - | - | - | - | - | 3.6 | 3.47 | - | - | 4.9 | 4.57 | - | - | - | - | - | - | - | 6.4 | 5.73 |
| 40 | 1 1/2 | 48.6 | - | - | - | - | - | - | 3.7 | 4.10 | - | - | 5.1 | 5.47 | - | - | - | - | - | - | - | 7.1 | 7.27 |
| 50 | 2 | 60.5 | - | - | - | - | - | - | 3.9 | 5.44 | - | - | 5.5 | 7.46 | - | - | - | - | - | - | - | 8.7 | 11.1 |

| | | | | | | | | | | | | | | | | | | | | | | |
|-----|-------|-------|-----|------|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 65 | 2 1/2 | 76.3 | - | - | - | - | - | - | 5.2 | 9.12 | - | - | 7.0 | 12.0 | - | - | - | - | - | - | 9.5 | 15.6 |
| 80 | 3 | 89.1 | - | - | - | - | - | - | 5.5 | 11.3 | - | - | 7.6 | 15.3 | - | - | - | - | - | - | 11.1 | 21.4 |
| 90 | 3 1/2 | 101.6 | - | - | - | - | - | - | 5.7 | 13.5 | - | - | 8.1 | 18.7 | - | - | - | - | - | - | 12.7 | 27.8 |
| 100 | 4 | 114.3 | - | - | - | - | - | - | 6.0 | 16.0 | - | - | 8.6 | 22.4 | - | - | 11.1 | 28.2 | - | - | 13.5 | 33.6 |
| 125 | 5 | 139.8 | - | - | - | - | - | - | 6.6 | 21.7 | - | - | 9.5 | 30.5 | - | - | 12.7 | 39.8 | - | - | 15.9 | 48.6 |
| 150 | 6 | 165.2 | - | - | - | - | - | - | 7.1 | 27.7 | - | - | 11.0 | 41.8 | - | - | 14.3 | 53.2 | - | - | 18.2 | 66.0 |
| 200 | 8 | 216.3 | - | - | 6.4 | 33.1 | 7.0 | 36.1 | 8.2 | 42.1 | 10.3 | 52.3 | 12.7 | 63.8 | 15.1 | 74.9 | 18.2 | 88.9 | 20.6 | 99.4 | 23.0 | 110 |
| 250 | 10 | 267.4 | - | - | 6.4 | 41.2 | 7.8 | 49.9 | 9.3 | 59.2 | 12.7 | 79.8 | 15.1 | 93.9 | 18.2 | 112 | 21.4 | 130 | 25.4 | 152 | 28.6 | 168 |
| 300 | 12 | 318.5 | - | - | 6.4 | 49.3 | 8.4 | 64.2 | 10.3 | 78.3 | 14.3 | 107 | 17.4 | 129 | 21.4 | 157 | 25.4 | 184 | 28.6 | 204 | 33.3 | 234 |
| 350 | 14 | 355.6 | 6.4 | 55.1 | 7.9 | 67.7 | 9.5 | 81.1 | 11.1 | 94.3 | 15.1 | 127 | 19.0 | 158 | 23.8 | 195 | 27.8 | 225 | 31.8 | 254 | 35.7 | 282 |
| 400 | 16 | 406.4 | 6.4 | 63.1 | 7.9 | 77.6 | 9.5 | 93.0 | 12.7 | 123 | 16.7 | 160 | 21.4 | 203 | 26.2 | 246 | 30.9 | 286 | 36.5 | 333 | 40.5 | 365 |
| 450 | 18 | 457.2 | 6.4 | 71.1 | 7.9 | 87.5 | 11.1 | 122 | 14.3 | 156 | 19.0 | 205 | 23.8 | 254 | 29.4 | 310 | 34.9 | 363 | 39.7 | 409 | 45.2 | 459 |
| 500 | 20 | 508.0 | 6.4 | 79.2 | 9.5 | 117 | 12.7 | 155 | 15.1 | 184 | 20.6 | 248 | 26.2 | 311 | 32.5 | 381 | 38.1 | 441 | 44.4 | 508 | 50.0 | 565 |
| 550 | 22 | 558.8 | - | - | - | - | - | - | 15.9 | 213 | 22.2 | 294 | 28.6 | 374 | 34.9 | 451 | 41.3 | 527 | 47.6 | 600 | 54.0 | 672 |
| 600 | 24 | 609.6 | - | - | - | - | - | - | 17.5 | 256 | 24.6 | 355 | 31.0 | 442 | 38.9 | 547 | 46.0 | 639 | 52.4 | 720 | 59.5 | 807 |
| 650 | 26 | 660.4 | - | - | - | - | - | - | 18.9 | 299 | 26.4 | 413 | 34.0 | 525 | 41.6 | 635 | 49.1 | 740 | 56.6 | 843 | 64.2 | 944 |

Remarks

- The designation of the pipe shall be based on the nominal diameter and the nominal wall thickness (schedule number: Sch). However, for the nominal diameter, either A or B shall be used, and the letter A or B shall be suffixed to the figures of nominal diameter, respectively, for identification.
- Calculate the value of mass from the following formula assuming 1 cm³ of steel to be 7.85g and round off the result to 3 significant figures in accordance with JIS Z 8401. However, the values in excess of 1000kg/m shall be rounded off to whole numbers in kg/m.

$$W=0.02466 t (D - t)$$

Where

W: unit mass of pipe(kg/m)

t: wall thickness of pipe(mm)

D: outside diameter of pipe(mm)

- When dimensions other than those given in the above table are necessary, agreement shall be made between the purchaser and the manufacturer.

Appendix. Supplementary Quality Requirements

The supplementary quality requirements shall apply only when requested by the purchaser, and shall be executed by the manufacturer on the designated items.

Z2 Elevated Temperature Yield Point or Proof Stress

Z2.1 The value of elevated temperature yield point or proof stress and the testing temperature of the pipe shall be agreed upon by the purchaser and the manufacturer.

Z2.2 The test piece and the test method shall be as specified JIS G 0567.

However, when it is practically difficult to take the test piece specified in JIS G 0567, the shape of the test piece shall be agreed upon by the purchaser and the manufacturer.

Z2.3 The method of sampling the test specimens and the number of test pieces shall be as follows. Take one test specimen for each lot of the same heat charge, and then from one test specimen take one test piece for each lot of the same testing temperature.

Z3 Ultrasonic Examination

Z3.1 The criteria of the working sensitivity in the ultrasonic examination shall be the division UB or UC specified in JIS G 0582, and there shall be no signal greater than those produced by the artificial defects of the reference test block.

Z3.2 The test method of the ultrasonic examination shall be as specified in JIS G 0582

Z3.3 The ultrasonic examination shall be performed for each pipe and the results shall conform to the requirements specified in (1).

Z4 Eddy Current Examination

Z4.1 The criteria of the working sensitivity in the eddy current examination shall be the division EV, EW, or EX specified in JIS G 0583, and there shall be no signal greater than those produced by the artificial defects of the reference test block.

Z4.2 The test method of the eddy current examination shall be as specified in JIS G 0583.

Z4.3 The eddy current examination shall be performed for each pipe and the results shall conform to the requirements specified in (1).

Material Comparison Tables (ASTM, KS, JIS, DIN, BS, NBN, NF, UNI)

| ASTM Standard | UNS NO. | KOREA/JAPANESE | | | GERMAN | | | | BRITISH | | | FRENCH | | |
|---|---------|------------------|-----------------|---------|-----------|------------|-----------------|-------------|------------|-----------|---------|----------------|-----------|---------|
| | | KS/JIS Symbol | KS/JIS Number | Remarks | DIN Type | DIN Number | Material Number | Remarks | B.S Number | B.S Grade | Remarks | AFNOR Type | NF Number | Remarks |
| A 335 Seamless Ferritic Alloy Steel Pipe for High Temperature Service | | | | | | | | | | | | | | |
| P1 | K11522 | SPA 12 / STPA 12 | D 3573 / G 3458 | (16) | 16Mo5 | | 1.5423 | (3a) | | | (3) | TU 15 D 3 | A49-213 | |
| P5 | K41545 | SPA 25 / STPA 25 | D 3573 / G 3458 | (16) | 12CrMo195 | | 1.7362 | WBL-590(3b) | 3604 | FHS 625 | CAT.2 | TU Z12 CD 5-05 | A49-213 | |
| P9 | S50400 | SPA 26 | D 3573 | (16) | | | | (3) | | HFS | CAT.2 | TU Z 10 | A49-213 | |

| | | | | | | | | | | | | | | |
|-----|--------|---------------------|--------------------|------|-----------|-------|--------|-----|------|----------------|-------|-------------------|---------|-----|
| | | STPA 26 | G 3458 | | | | | | | 629-470 | | CD 9 | | |
| P11 | K11597 | SPA 23 / STPA 23 | D 3573 / G 3458 | (16) | 13CrMo44 | 17175 | 1.7335 | (8) | 3604 | HFS 621 | CAT.2 | TU 10 CD 5.05 | A49-213 | |
| P12 | K44562 | SPA 22 / STPA 22 | D 3573 / G 3458 | (16) | 13CrMo44 | 17175 | 1.7335 | | 3604 | HFS 620-440 | CAT.2 | | | (3) |
| P22 | K21590 | SPA 24 / STPA 24 | D 3573 / G 3458 | (16) | 10CrMo910 | 17175 | 1.7380 | | 3604 | HFS 622 | CAT.2 | TTU 10 CD 9.10 | A49-213 | |

JIS Number and Corresponding Foreign Standards

| JIS | | | ASTM | | | BS | | | DIN | | | NF | | | ISO | | | Index Number |
|-----------------|--------|------|-----------------|-------|------|-----------------|------------|------|-----------------|-----------|------|-----------------|------------|------|-----------------|-------|------|--------------|
| Standard Number | Grade | Type | Standard Number | Grade | Type | Standard Number | Grade | Type | Standard Number | Grade | Type | Standard Number | Grade | Type | Standard Number | Grade | Type | |
| G3458 | STPA12 | Mo | A335 | P1 | Mo | | | | | | | | | | | | | C006 |
| | STPA20 | CrMo | A335 | P2 | CrMo | | | | | | | A49-213 | TU15CD205 | CrMo | | | | |
| | STPA22 | CrMo | A355 | P12 | CrMo | 3604 | HFS620-460 | CrMo | 17175 | 13CrMo44 | CrMo | | | | | | | |
| | | | | | | " | CFS620-460 | CrMo | | | | | | | | | | |
| | | | | | | " | ERW620-460 | CrMo | | | | | | | | | | |
| | | | | | | " | CEW620-460 | CrMo | | | | | | | | | | |
| | | | | | | " | HFS620-440 | CrMo | | | | | | | | | | |
| | | | | | | " | CFS620-440 | CrMo | | | | | | | | | | |
| | | | | | | " | ERW620-440 | CrMo | | | | | | | | | | |
| | STPA23 | CrMo | A355 | P11 | CrMo | 3604 | HFS621 | CrMo | | | | A49-213 | TU10CD5.05 | CrMo | | | | |
| | | | | | | " | CFS621 | CrMo | | | | | | | | | | |
| | | | | | | " | ERW621 | CrMo | | | | | | | | | | |
| | | | | | | " | CEW621 | CrMo | | | | | | | | | | |
| | STPA24 | CrMo | A355 | P22 | CrMo | 3604 | HFS622 | CrMo | 17175 | 10CrMo910 | CrMo | A49-213 | TU10CD9.10 | CrMo | | | | |

