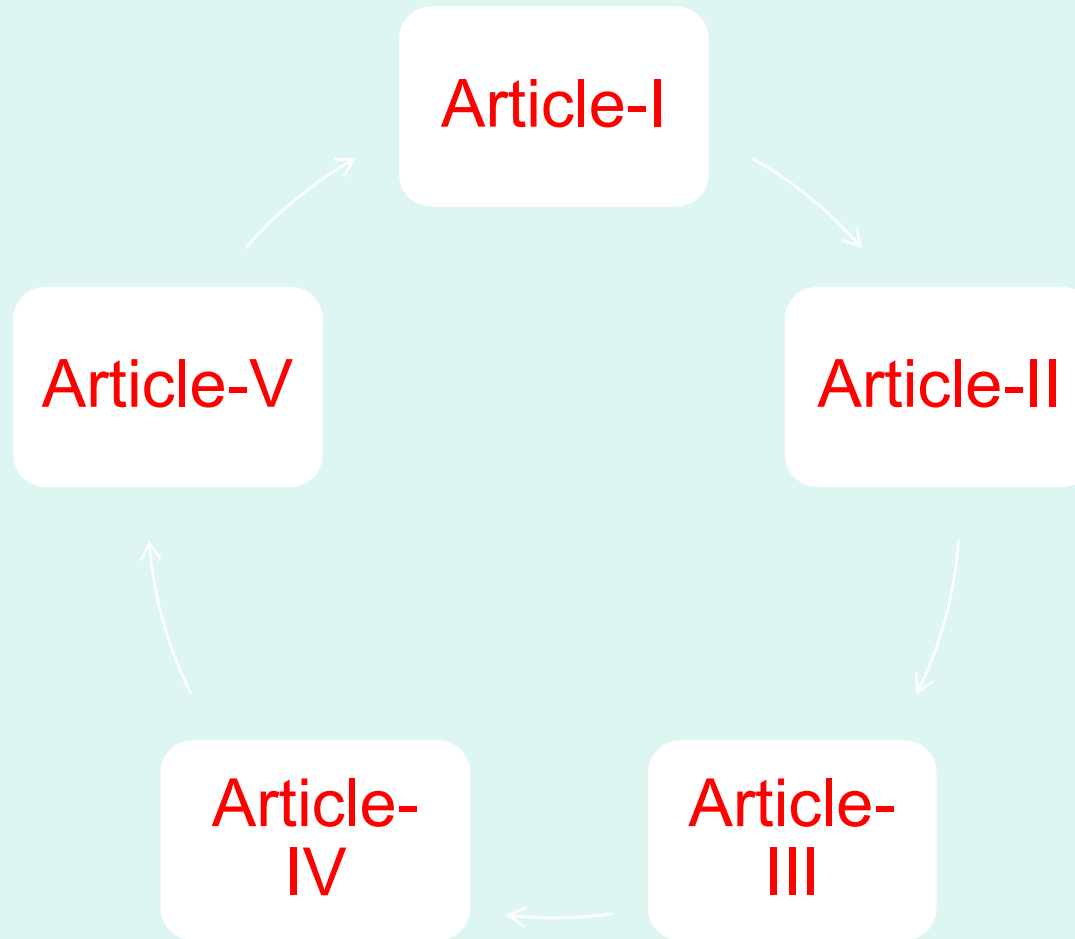


ASME / API / AWS Group...



Topic – ASME SEC-IX
QW- Welding

QW-Welding



QW-Welding

Article-I

Welding General Requirements

Article-II

Welding Procedure Qualifications

Article-III

Welding Performance Qualifications

Article-IV

Welding Data

Article-V

Standard Welding procedure specification

Article-I

Welding General requirements

- **QW-100- Scope**

Rules for preparation of Welding procedure qualification and welder performance qualification

- **QW-101 - Use of WPS**

WPS used by organization to controlled the operation of production welding.

- **QW-102 - Use of WPQ**

In performance qualifications basic criterion established for welder qualification is to determine the welder's ability to deposited sound weld metal.



Article-I

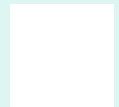
Welding General requirements

- **QW-103- Responsibility**
- **QW-103.1 –Welding**

Each organization shall conduct the tests required in this section to qualify the welding procedure used in the construction of weldments build under this code and the performance of welders and welding operator who apply these procedure.

- **QW-103.2 –Record**

Each organization shall maintain the record of the result of welding procedure qualification and welder performance qualification.



- **Weld Orientation QW-110**

- Weld orientation of weld as per below image given in QW461.1, QW461.2 & QW461.5, QW461.6

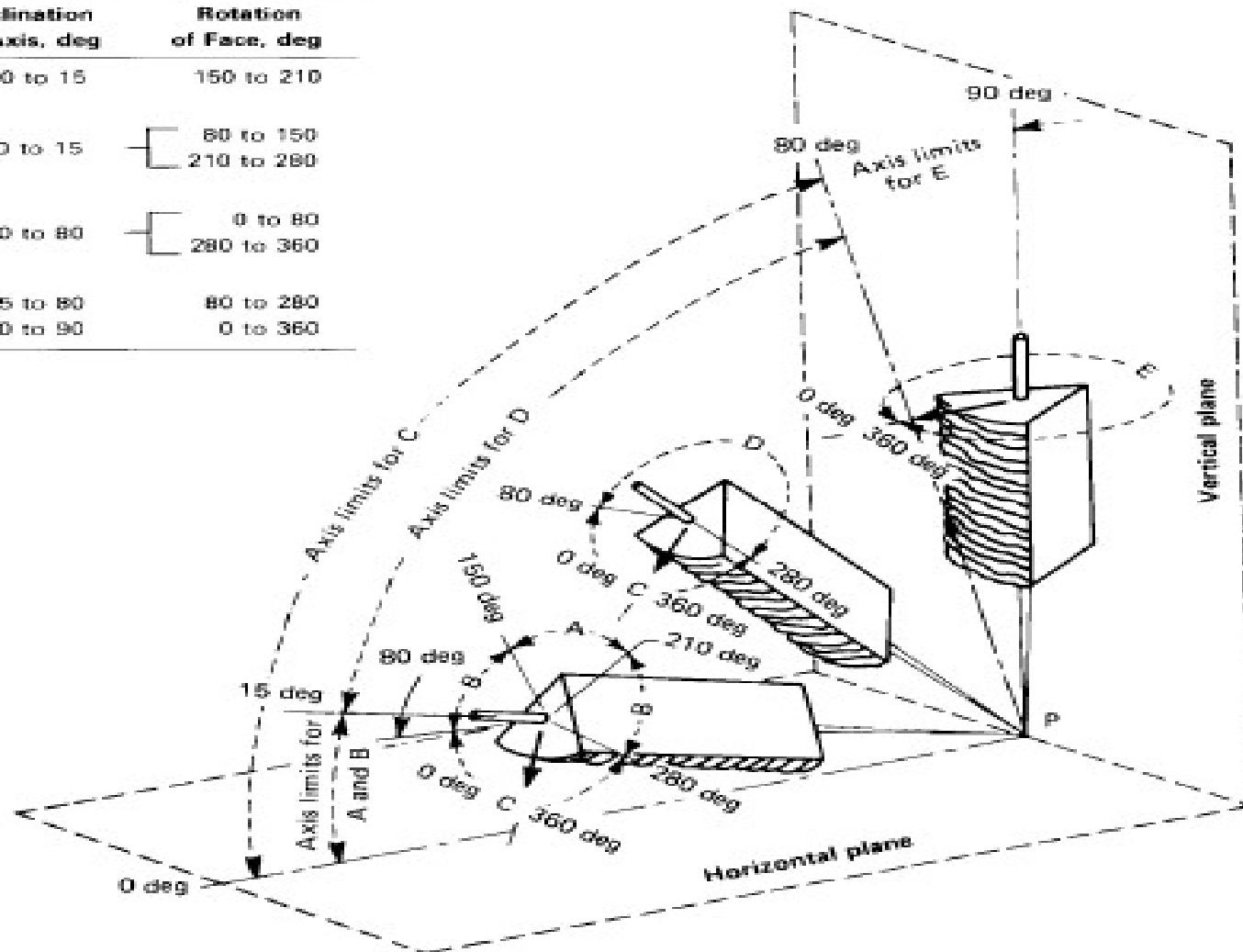
- **QW-120 & QW-130 Test Position of groove weld.**

Groove welds may be made in test coupons oriented in any of the positions an angular deviation of ± 15 deg from the specified horizontal and vertical planes, and an angular deviation of ± 5 deg from the specified inclined plane are permitted during welding.



**Figure QW-461.1
Positions of Welds — Groove Welds**

Tabulation of Positions of Welds			
Position	Diagram Reference	Inclination of Axis, deg	Rotation of Face, deg
Flat	A	0 to 15	150 to 210
Horizontal	B	0 to 15	80 to 150
			210 to 280
Overhead	C	0 to 80	0 to 80
			280 to 360
Vertical	D	15 to 80	80 to 280
	E	80 to 90	0 to 360



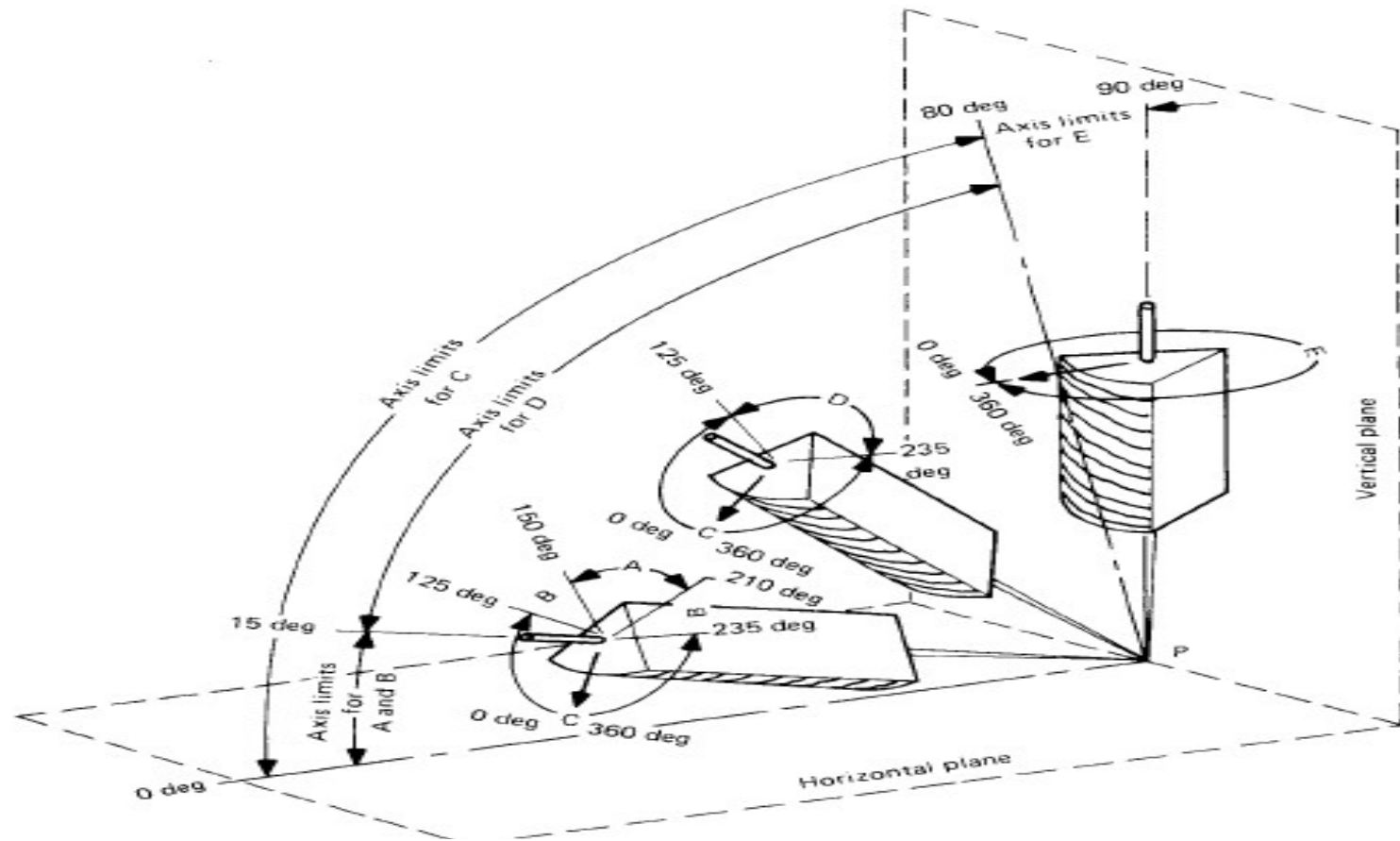
GENERAL NOTES:

- The horizontal reference plane is taken to lie always below the weld under consideration.
- Inclination of axis is measured from the horizontal reference plane toward the vertical.
- Angle of rotation of face is measured from a line perpendicular to the axis of the weld and lying in a vertical plane containing the axis. The reference position (0 deg) of rotation of the face invariably points in the direction opposite to that in which the axis advances. The angle of rotation of the face of weld is measured in a clockwise direction from this reference position (0 deg) when viewed from point P.

**Figure QW-461.2
Positions of Welds — Fillet Welds**

Tabulation of Positions of Fillet Welds

Position	Diagram Reference	Inclination of Axis, deg	Rotation of Face, deg
Flat	A	0 to 15	150 to 210
Horizontal	B	0 to 15	125 to 150 210 to 235
Overhead	C	0 to 80	0 to 125 235 to 360
Vertical	D	15 to 80	125 to 235
	E	80 to 90	0 to 360

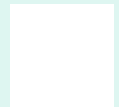
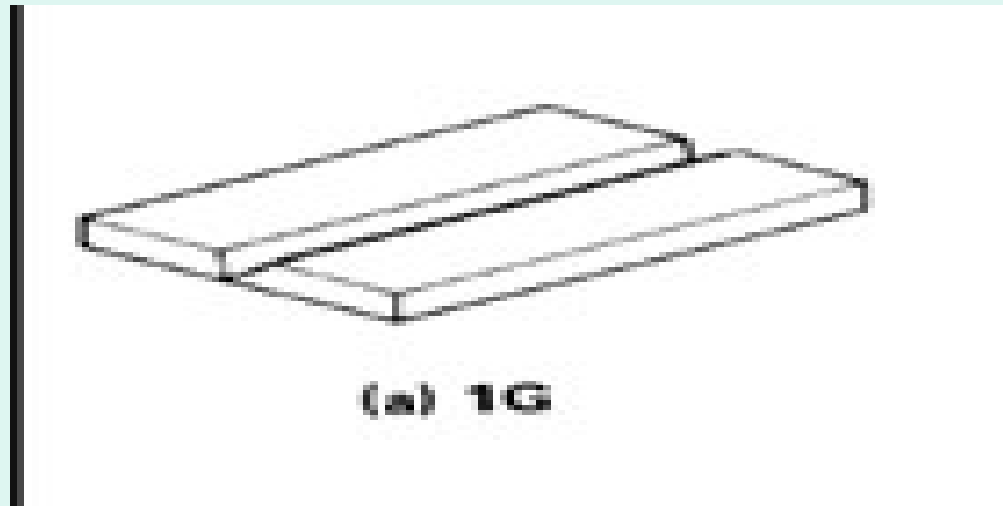


QW121-Test Positions For Plate Groove Weld

- There are total four positions for plate groove welds
- 1G,2G,3G and 4G

Flat Position of 1G-

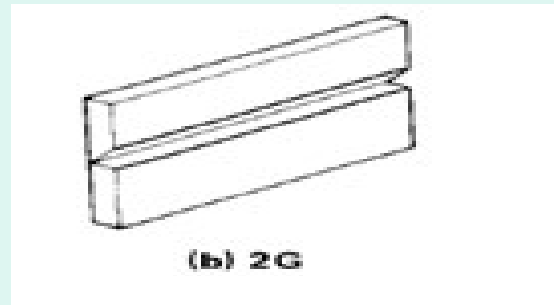
Plate in a horizontal plane with the weld metal deposited from above.



QW121-Test Positions For Plate Groove Weld

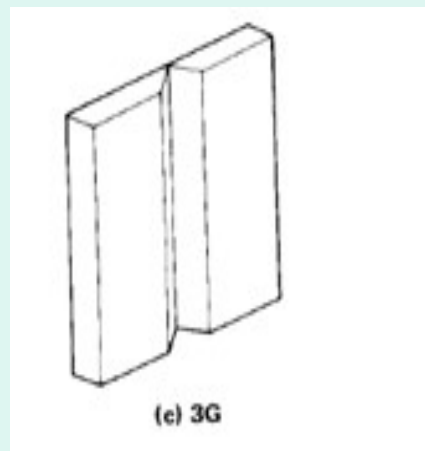
Horizontal Position of 2G-

Plate in a vertical plane with the axis of the weld horizontal.



Vertical Position of 3G-

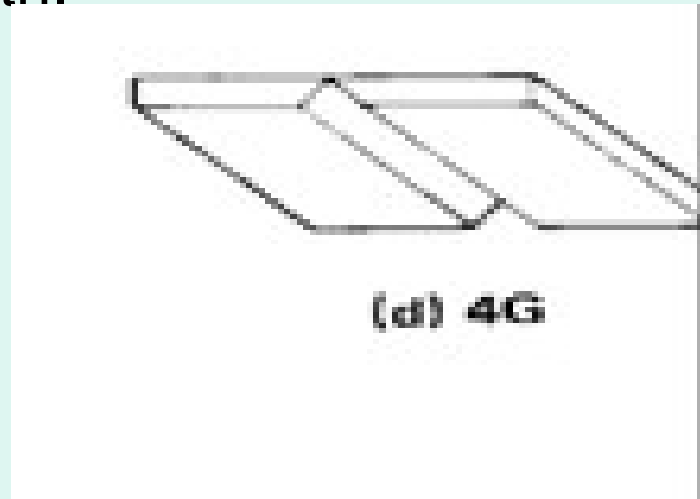
Plate in a vertical plane with the axis of the weld vertical..



QW121-Test Positions For Plate Groove Weld

Overhead Position of 4G-

Plate in a horizontal plane with the weld metal deposited from underneath.

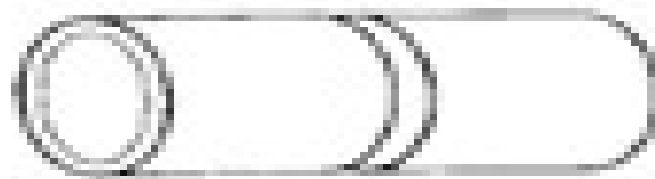


QW122-Test Positions For pipe Groove Weld

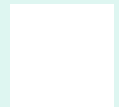
- There are total four positions for pipe groove welds
- 1G,2G,5G and 6G

Flat Position of 1G-

Pipe with its axis horizontal and rolled during welding so that the weld metal is deposited from above.



(a) 1G Flat



QW122-Test Positions For pipe Groove Weld

Horizontal Position 2G.

Pipe with its axis vertical and the axis of the weld in a horizontal plane. Pipe shall not be rotated during welding.



Multiple Position 5G.

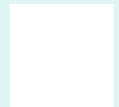
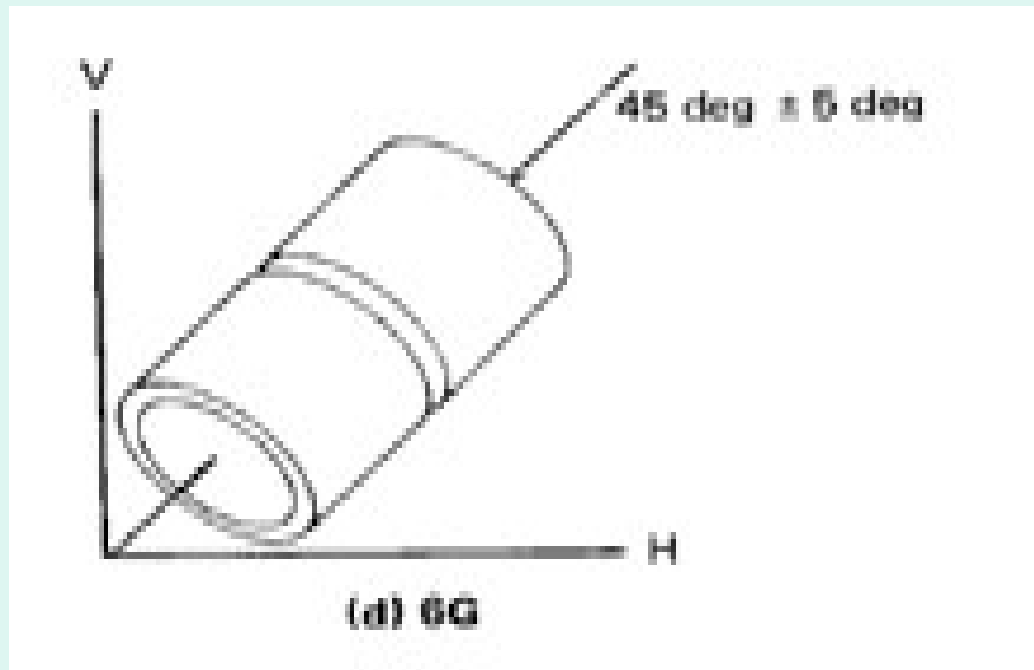
Pipe with its axis horizontal and with the welding groove in a vertical plane. Welding shall be done without rotating the pipe.



QW122-Test Positions For pipe Groove Weld

Multiple Position 6G.

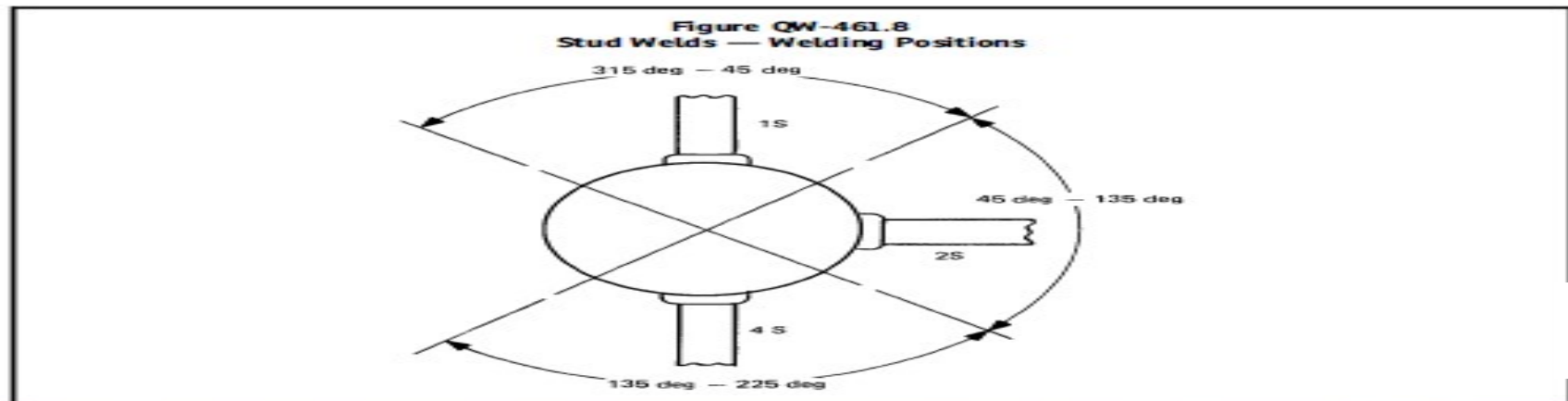
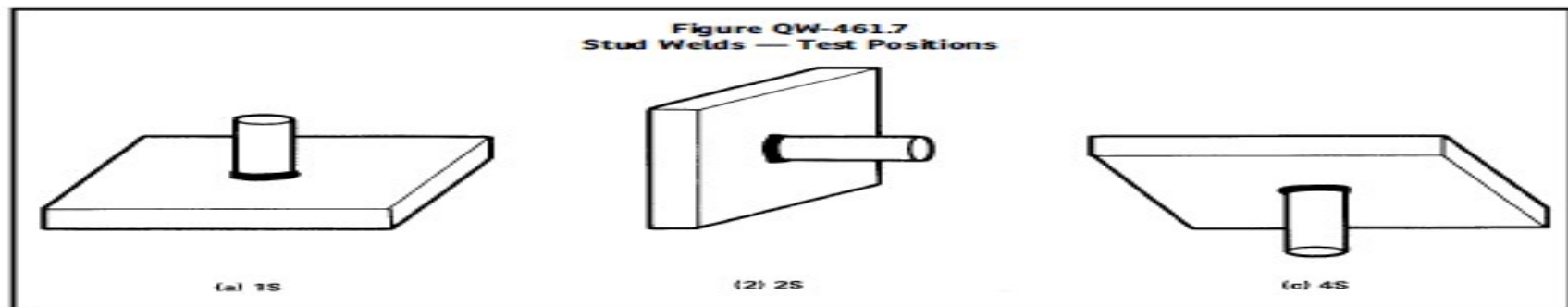
Pipe with its axis inclined at 45 deg to horizontal. Welding shall be done without rotating the pipe.



QW123-Test Positions For Stud Weld

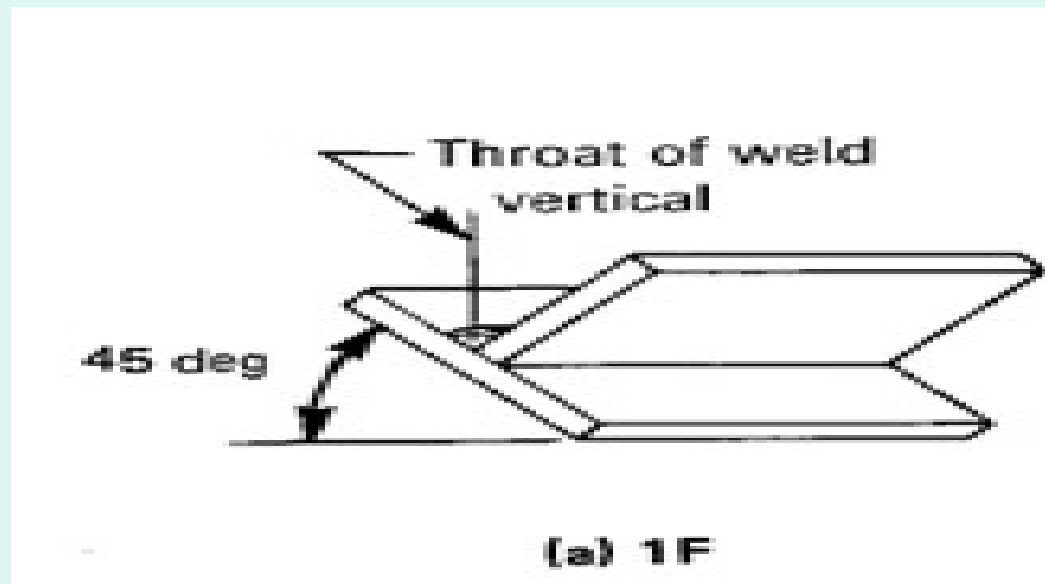
Stud Weld.

Stud welds may be made in test coupons oriented in any of the positions as described in above mentioned positions for plate and pipe (excluding 1G of Pipe).



QW131-Test Positions For Plate Fillet Weld

- There are total four positions for plate fillet welds
- 1F,2F,3F and 4F
- **Flat Position 1F.**
- Plates so placed that the weld is deposited with its axis horizontal and its throat vertical

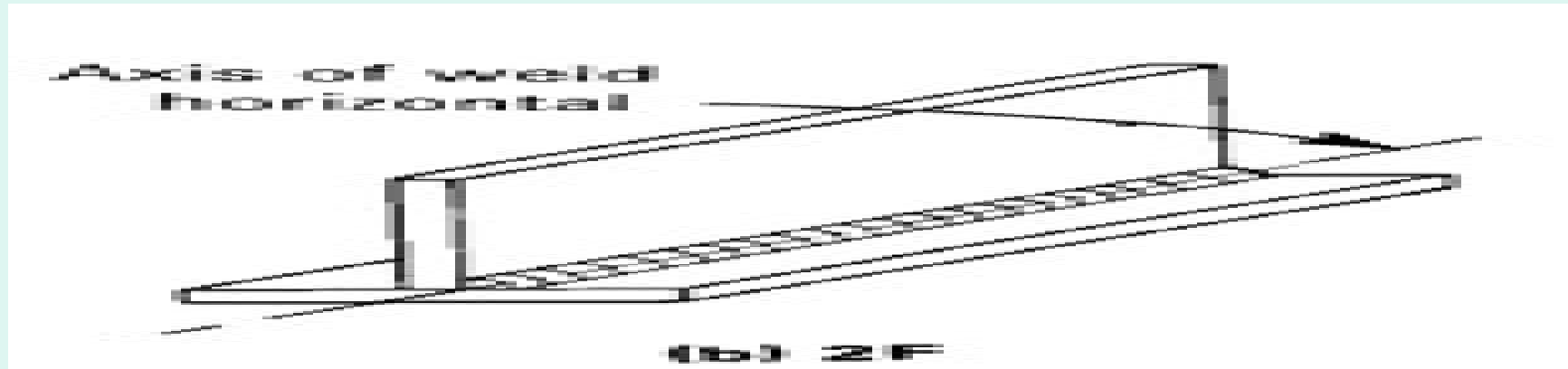


QW131-Test Positions For Plate Fillet Weld

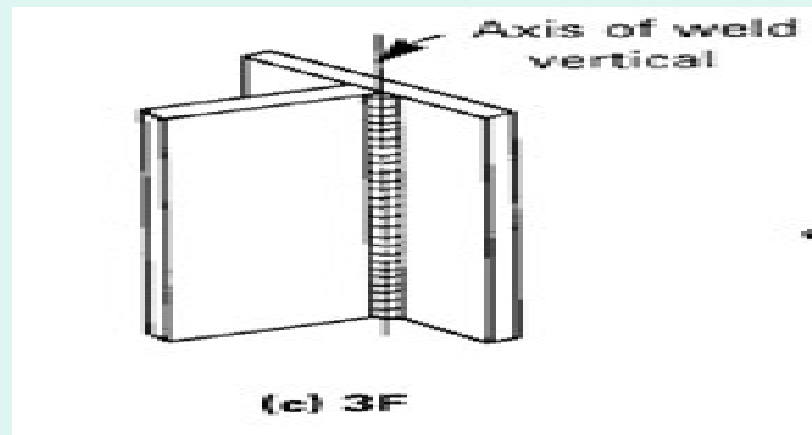
- There are total four positions for plate groove welds
- 1F,2F,3F and 4F
- **Horizontal Position 2F.**
- Plates so placed that the weld is deposited with its axis horizontal on the upper side of the horizontal surface and against the vertical surface.
- **QW-131.3 Vertical Position 3F.** Plates so placed that the weld is deposited with its axis vertical
- **QW-131.4 Overhead Position 4F.** Plates so placed that the weld is deposited with its axis horizontal on
- the underside of the horizontal surface and against the vertical surface.



- **Horizontal Position 2F.**
- Plates so placed that the weld is deposited with its axis horizontal on the upper side of the horizontal surface and against the vertical surface.

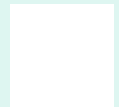
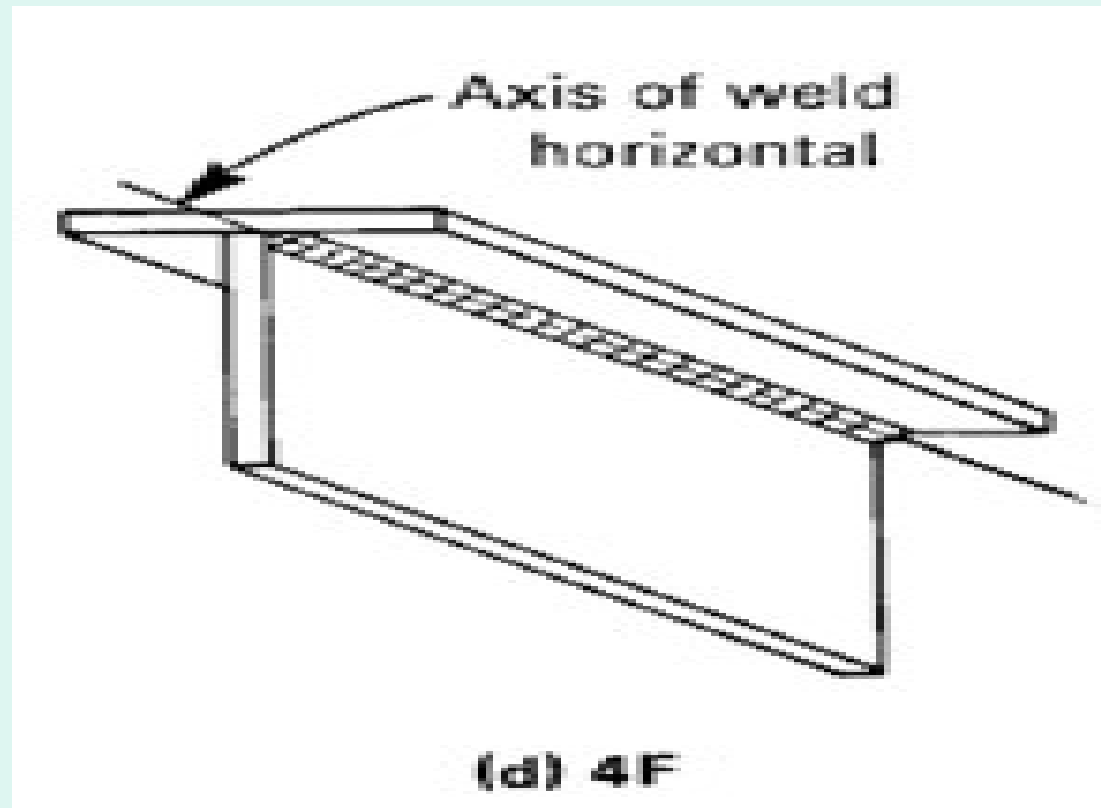


- **QW-131.3 Vertical Position 3F.** Plates so placed that the weld is deposited with its axis vertical



QW131-Test Positions For Plate Fillet Weld

- **QW-131.4 Overhead Position 4F.** Plates so placed that the weld is deposited with its axis horizontal on the underside of the horizontal surface and against the vertical surface.

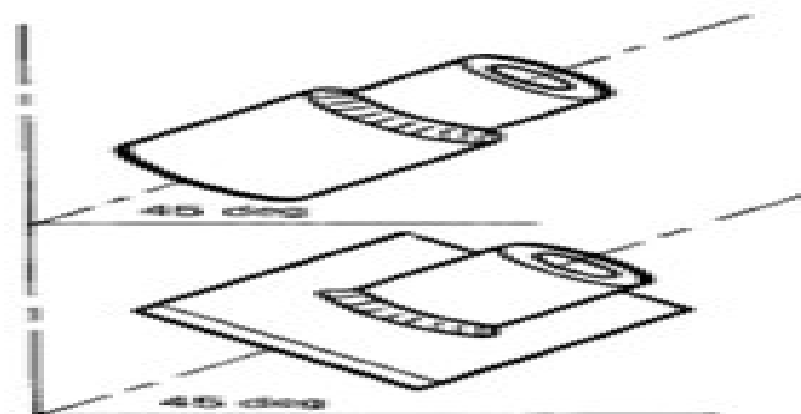


QW132-Test Positions For pipe Fillet Weld

- There are total four positions for pipe fillet welds
- 1F,2F/2FR,4F and 5F

Flat Position 1F.

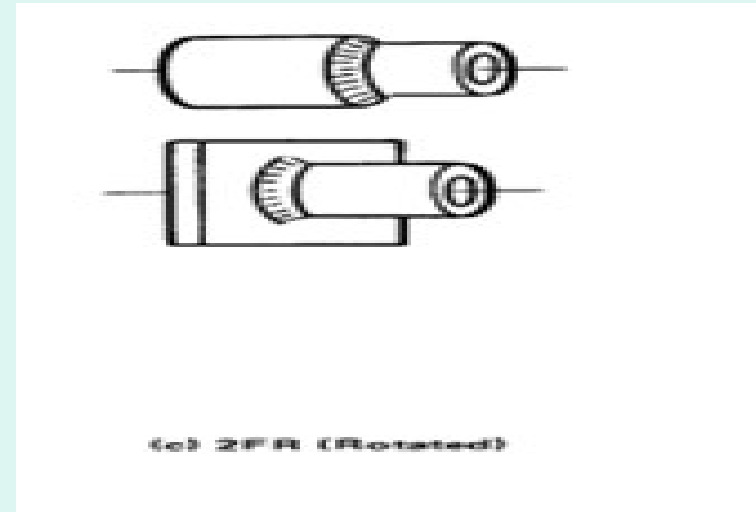
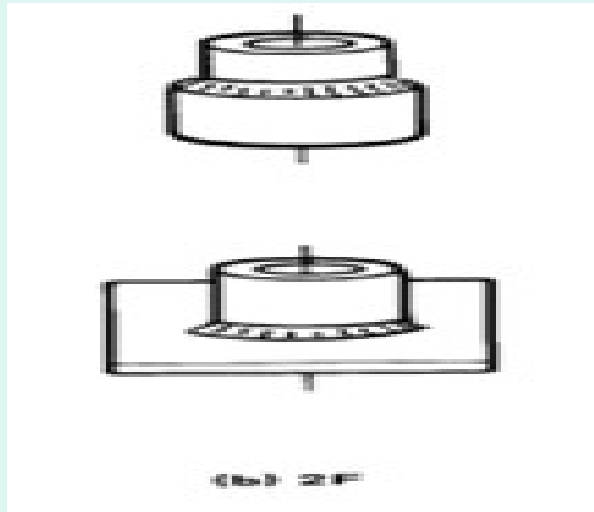
- Pipe with its axis inclined at 45 deg to horizontal and rotated during welding so that the weld metal is deposited from above and at the point of deposition the axis of the weld is horizontal and the throat vertical.



(a) 1F (Rotated)

QW132-Test Positions For pipe Fillet Weld

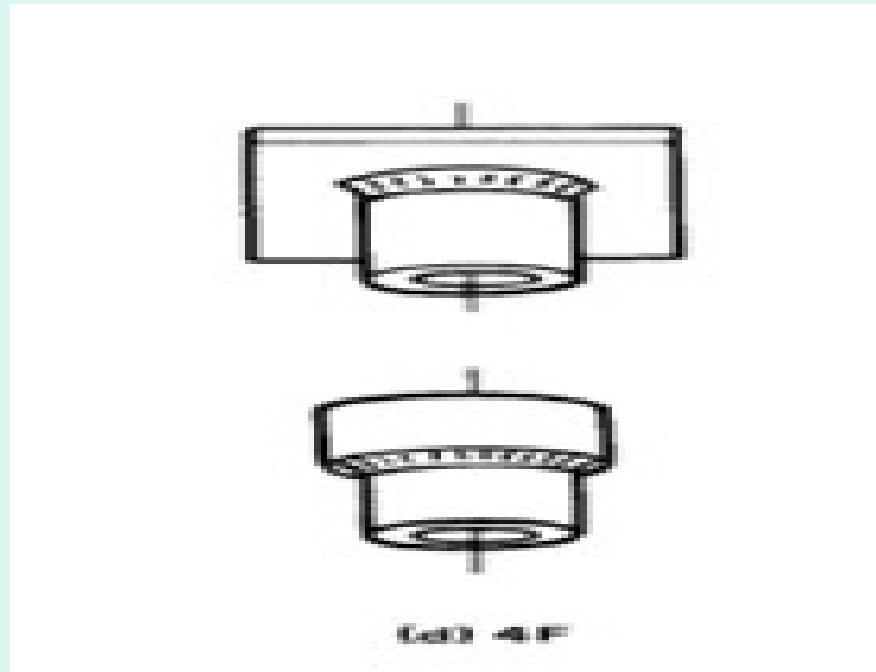
- **Horizontal Positions 2F and 2FR.**
- **(a) Position 2F.** Pipe with its axis vertical so that the weld is deposited on the upper side of the horizontal surface and against the vertical surface. The axis of the weld will be horizontal and the pipe **is not to be rotated during welding.**
- **(b) Position 2FR.** Pipe with its axis horizontal and the axis of the deposited weld in the vertical plane. The pipe is rotating during the weld.



QW132-Test Positions For pipe Fillet Weld

Overhead Position 4F.

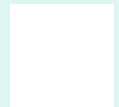
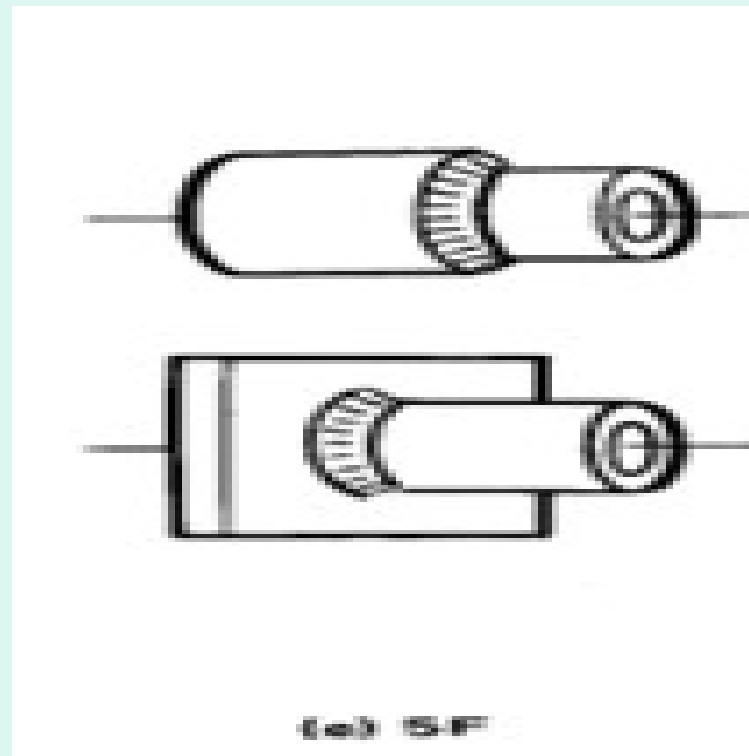
Pipe with its axis vertical so that the weld is deposited on the underside of the horizontal surface and against the vertical surface. The axis of the weld will be horizontal and the pipe is **not to be rotated during welding.**



QW132-Test Positions For pipe Fillet Weld

Multiple Position 5F.

Pipe with its axis horizontal and the axis of the deposited weld in the vertical plane. The pipe is not to be rotated during welding.



QW140-Type of test

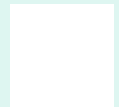
QW141-Mechanical Test.

- Tension test
- Guided bend test
- Fillet weld test (Fracture Test & Macro Test)
- Notch Toughness test (for Impact requirement only)
- Stud weld test (Hammering, Tension and Torque)

QW142 / 143- Special examinations /Test.

- Radiography test
- Ultrasonic test

QW144- Visual examination.



Test Procedure & Acceptance criteria

Reduce Section-

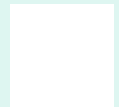
Reduce section specimen confirming to the requirements given in above image

For thickness up to 25mm full thickness specimen shall be used

For thickness greater than 25 mm full thickness specimen or multi specimen may be used

When multi specimens are used lie of full thickness each set shall represented as single tension test of full thickness.

For multi specimen should be cut mechanically. (By thermal cut / Machining)

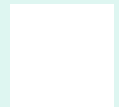


Test Procedure & Acceptance criteria

QW-153 Acceptance Criteria-

Tensile test strength not less than

- Minimum specific tensile strength of base metal
- If two different size thickness minimum tensile strength of weaker section.
- If specimen break in weld metal outside of weld or interface test shall be accepted but test result value should not less than 5% of base metal strength.
- For aluminium cladding up 13 mm or greater the specific tensile strength is for both full thickness specimen including cladding and specimen taken from core.

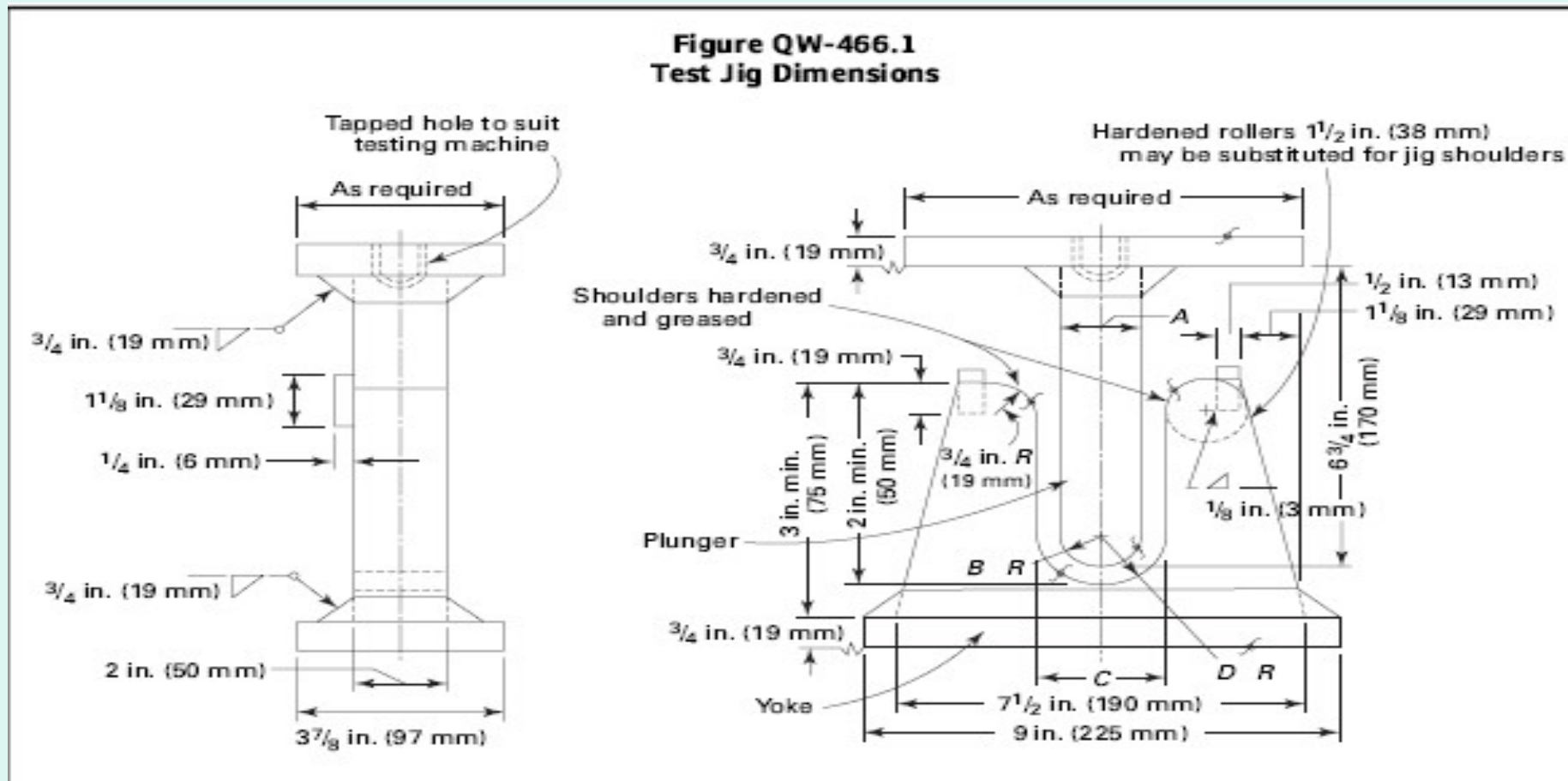


Test Procedure & Acceptance criteria

QW160- Guided bend test.

- QW-161 Specimens

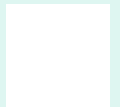
Specimen made as per QW-466.1, QW-466.2 and QW466.3



Test Procedure & Acceptance criteria

QW-163 Acceptance Criteria-

The guided bend test specimen shall have no open discontinuity in the weld or heat affected zone exceeding 3mm.



Test Procedure & Acceptance criteria

QW191- Radiography Test.

Radiography test should be conduct as per SEC V Article -2

Definitions-

Linear indication- Crack , incomplete fusion, inadequate penetration and slag are represented on radiograph as linear indication length is more than 3 times of width

Rounded indication- Porosity, inclusion of slag and tungsten are represented on radiograph as rounded indication length is less or 3 times of width



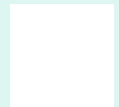
Test Procedure & Acceptance criteria

Acceptance Criteria-

The test piece not accepted when radiograph exhibits any imperfection in excess of the limit specified below

For linear indication-:

1. Any type of crack or incomplete fusion or penetration.
2. Any elongate slag inclusion has a length greater than
 - a) 3 mm for Thickness t up to 10 mm
 - b) $1/3t$ for t over 10 mm to 57 mm
 - c) 19 mm for t more than 57mm
3. Any group of the slag inclusion in line that have aggregate more than t of length $12t$, Except when the distance between successive imperfection exceed $6L$, Where L is the length of longest imperfection.

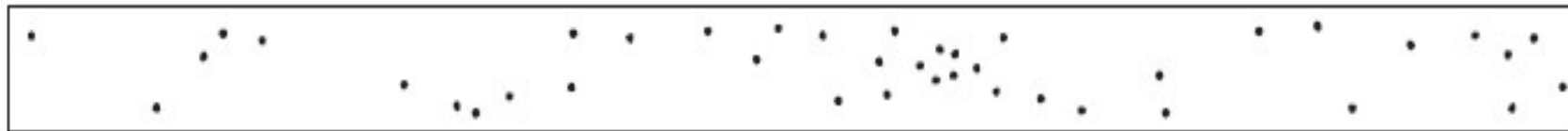


Test Procedure & Acceptance criteria

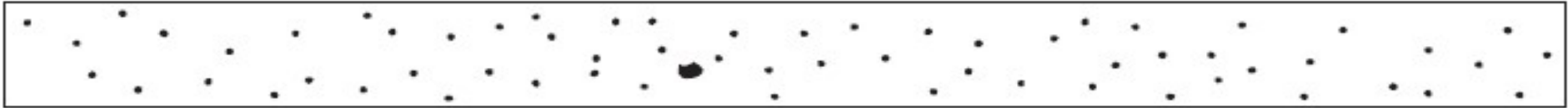
Acceptance Criteria-

For Rounded indication-:

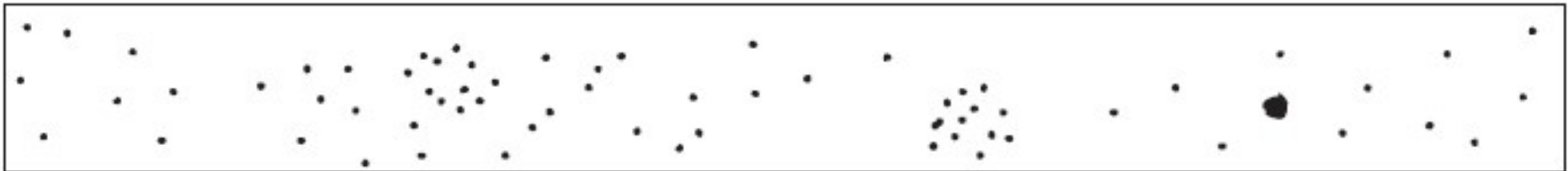
1. The maximum permissible dimension for rounded indication is 20%t or 3mm which is smaller.
2. For weld material thickness up to 3mm, The maximum number of rounded indication shall not exceed 12 for 6 Inch length.
3. For weld material thickness 3mm or greater than 3 mm below chart to be refer. QW191.1.2.2(b)(4) to be re



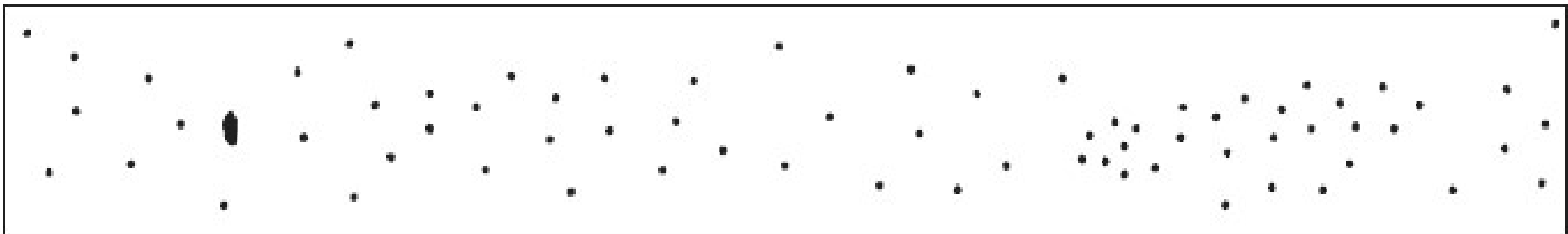
Typical Quantity and Size Permitted
in 6 in. (150 mm) Length of Weld
 $\frac{1}{8}$ in. (3 mm) to $\frac{1}{4}$ in. (6 mm)
Thickness



**Typical Quantity and Size Permitted
in 6 in. (150 mm) Length of Weld
Over $\frac{1}{4}$ in. (6 mm) to $\frac{1}{2}$ in. (13 mm)
Thickness**



**Typical Quantity and Size Permitted
in 6 in. (150 mm) Length of Weld
Over $\frac{1}{2}$ in. (13 mm) to 1 in. (25 mm)
Thickness**



**Typical Quantity and Size Permitted
in 6 in. (150 mm) Length of Weld
Over 1 in. (25 mm) Thickness**

Test Procedure & Acceptance criteria

QW191.2- Ultrasonic examination.

Ultrasonic examination shall be conducted when weld thickness greater than 6 mm.

Examination shall be performed using written procedure as per SEC V article 1 T-150 and requirements of SEC V article 4 for method, procedure and qualifications.



Test Procedure & Acceptance criteria

Acceptance Criteria-

Indication shall be evaluate and unaccepted as below

1. Any type of crack or incomplete fusion or penetration.
2. Any indication their length greater than
 - a) 3 mm for Thickness t up to 10 mm
 - b) $1/3t$ fot t over 10 mm to 57 mm
 - c) 19 mm for t more than 57mm
3. Any group of the slag inclusion in line that have aggregate more than t of length $12t$, Except when the distance between successive imperfection exceed $6L$, Where L is the length of longest imperfection.

