

Tata Steel IJmuiden Projects & Technical Consultancy	 
KDT Kwaliteitsmanagementsysteem KDT-FORM-045-EN Explanation Golden Weld	

1 Scope

This procedure deals with the use of "Golden Welds" in the in-service phase, in the case of repairs, changes or structural changes, on the Tata Steel IJmuiden site. This is a supplement to the general Tata Steel welding standard S1 45 04 01 "Execution and inspection of welding work", final revision and means that all qualifications, certification, welding documentation and NDT must meet and follow all requirements stated in the welding standard when making from a Golden Las.

2 Preface

The golden weld is based on the (Dutch) PRDA section 2.5 chapter 10. If a weld on pressure equipment cannot be subjected to a pressure test (hydrostatic or pneumatic), while the design code of the pressure equipment prescribes this, it is called a "golden weld". In that case the steps, as described in this explanation, must be followed..

3 Requirements for applying a golden weld

A hydrostatic pressure test must always be carried out after welding. It is, however, permissible not to carry out the hydrostatic pressure test if it is harmful or practically impossible. Some typical examples:

- For overhead lines, the weight becomes too high for the span, there is a risk of sagging and bending.
- The presence of residual water is unacceptable for the process and / or due to the presence of many branches at the bottom, which cannot be sufficiently drained and dried.
- The pipe cannot be blocked and tested in practical test lengths.
- Due to environmental restrictions due to large quantities of contaminated water.

If a hydrostatic test cannot be performed, the **first alternative** is a gas-filled test (usually with air or with nitrogen), as stated in the design code. However, this is not a "standard" alternative. I.e. due to safety there must be made a separate plan of approach.

If a gas press test is also not a realistic option, the "Golden weld" procedure shall be followed as the last option. The fit-up and the weld itself must meet all of the following 5 conditions:

1. The weld must be made as a blunt seam and fully welded;
2. The weld must be a pipe-to-pipe connection, a pipe bend, pipe T-piece or pipe-reducing or the like is not allowed.
3. The pipe sections must be arranged stress-free in relation to each other;
4. The weld must be laid in at least 2 layers;
5. The weld must be easily accessible for the welding method and NDT techniques to be used. A point of attention during the design / recording of the work is the location of the connection.

4 Preparation

4.1 Documentation

The following documentation shall be send in advance to KDT, or DTD for equipment / pipes subject to inspection, for approval:

1. KDT-FORM-019 “**Motivation Golden Weld**”, to be completed by the system administrator of the work unit / client / owner as completely as possible, if necessary, occasionally with the help of the contractor. This must clearly state what the technical and financial problems are if a (hydrostatic or gas) press test should be carried out.
2. **P&ID of the system**, the location of the golden weld clearly marked.
3. **Construction drawing** on which the location of the golden weld is indicated, and possibly photos.
4. **Inspection and Test Plan (ITP)**. The required certificates and documents must at least comply with the welding standard S1 45 04 01. Depending on the circumstances, additional requirements may be set. These must be recorded in the ITP.

4.2 Execution

Performing NDT prior to welding: If the Golden Weld connects to an old(er) pipe, it is recommended to pre-inspect with UT the old pipe on inclusions & laminations and examine for sufficient residual wall thickness. If there are inclusions, or the wall thickness has decreased, another location for the Golden Weld can be chosen.

5 Execution of fit-up and welding

Tack welding should preferably be done with bullets. Tacking with a bridge is permitted for welding in pipes with a wall thickness of less than or equal to 4 mm, if it is not possible to tack with bullets.

In all cases, tack welds may NOT be included in the welds, they MUST be removed just before welding the root layer.

The bullets must be of weldable steel quality and from the same material group as the base material. Make tack welds only on the weld edge preparation. The size of the bullet must be proportional to the size of the weld bevel.

If the installation falls under the DTD (statutory), the DTD must inspect the fit-up of the gold weld(s).

Welding shall be done according to pre-approved LMB / WPS, by welder(s) with valid certificate(s).

6 Inspection and NDT after welding

Inspection and NDT must be carried out according to table 1, whereby the design code of the system and the requirements stated therein regarding NDT execution and acceptance are leading.

If the weld seam / seams are heat-treated after welding, the NDT must take place after the heat treatment.

If the combination of base material - welding process is susceptible to cracking, such as hydrogen cracking, a minimum applicable holding time shall be maintained before NDT is carried out.

If one or more of the above conditions cannot be met, there must be:

- Another weld is designated as a Golden Weld, or
- In consultation with the DTD / KDT, another, at least equivalent, inspection plan must be agreed

7 Repair

During preparation, it must be established how to deal with any welding rejection. Options are:

- 1) Repair according to used WPS, or
- 2) Make a separate repair procedure.

I.e. depending on circumstances, defect type and defect location in the weld. The chosen option must always be assessed by the KDT welding expert and recorded in the ITP.

8 Tightness test

A leak-tightness test must be carried out before paint, coating and / or insulation is applied, with the installation filled with the medium and at working pressure. The leak tightness test must be conducted by the designated inspector¹⁾. Only after the leak-tightness test is acceptable, the paint, coating and / or insulation may be applied.

If the medium is pumped at elevated temperature, the leak tightness test with medium is not always possible. If the medium is pumped under reduced pressure, the leak-tightness test is only possible with ultrasonic listening equipment.

If a leak tightness test is not possible or is canceled, this will always be stated in the ITP / QIP, with a motivation.

9 Documentation

All documentation must be unambiguous and consistently traceable to the golden weld in question. As a minimum, the following must be stated on all documents (as a supplement to the ITP and related documentation, as stated under Chapter 3):

- 1) Which installation is involved.
- 2) Characteristic of the installation: As recorded and indentified in the maintenance system, and if applicable; as known to the DTD (DR / K / L / V number). All DR / K / L / V numbers must be specified separately in case of a collective report.
- 3) Weld number or location of the golden weld indicated on ISO and / or LISL.
- 4) Date on which the golden weld was made.

Remarks:

¹⁾ : Designated inspector is for installations subject to inspection: DTD inspector, for installations not subject to inspection: Tata Steel inspector.

10 Table Inspection and NDT requirements for Golden Welds

Remark: The welding category is only valid for existing installations.

Welding category of the <i>pipng system</i> where the Golden Weld comes in: (Welding standard S1 45 05 01 Chapter 9.)	New & 1	2	3
Form "Golden Weld Motivation", to be completed by client / WE, possibly. completed by contractor, then submit to designated inspector ¹⁾	Yes	Yes	Yes
Weld bevel inspection of crack-sensitive material, or "old" material (magnetic, or if not possible, penetrant)	Yes	Yes	No
Fit-up acceptance by designated inspector ¹⁾	Yes	Yes	No
Visual inspection after welding by designated inspector ¹⁾	Yes	Yes	Yes
Volumetric examination: RT examination (X-ray or isotope) ^{2) 3)}	Yes	Yes ³⁾	No
Volumetric examination: UT examination (with wall thickness > = 8 mm) ^{3) 4)}	Yes	³⁾	No
Surface examination (magnetic or penetrant) ⁵⁾	Yes	Yes	Yes
Acceptance criteria according to design code:			
RTtoD: T0110, VT: T0112; RT: T0111; UT: T0117; MT/PT: T0110			
EN13445 (Pressure Vessels) → VT: EN5817 Class :	B	C	D
EN13480 / EN15001 (Pipe work/Piping) → VT: EN5817 Class :	B	C	D
Final test:			
Tightness test with product at working pressure (see chapter. 8)	Yes	Yes	Yes

Remarks:

1): Designated inspector is for installations subject to inspection: DTD inspector, for installations not subject to inspection: Tata Steel inspector.

2): X-ray examination is always the first choice, if this is not applicable, an isotope may be used. If an isotope and a single wall thickness <14 mm (or <7 mm with double wall irradiation!) are used, additional NDT requirements apply and the KDT-FORM-032 "Se75 thin wall motivation test" form must be completed.

3): With pipes / pressure systems, which fall as a whole in Welding category 2 (Golden Weld itself is always welding category 1!) and with wall thickness > = 8 mm, one may choose between RT or UT angle beam examination for the volumetric examination, whichever is the most practical.

RT is mandatory for wall thickness <8 mm (for all welding categories), because UT is practically not possible, or Phased array (PAUT) should be selected for WT >= 3.2 mm

4): US Corner test can always be used. ToFD and / or Phased array are not described in the design codes, therefore applying ToFD and / or Phased array always requires the prior approval of the DTD / CBI / Nobo.

5): Magnetic testing for all ferritic steels, penetrant for all non-magnetizable steels, metals & alloys

11 References

KDT-FORM-019-EN "Motivation Golden weld"

KDT-FORM-032-EN "Motivation Se75 thin wall inspection"