

MATERIAL SELECTION**JGS 210-120-1-19E**

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1. SCOPE

- (1) This standard practice covers the selection of materials for processing facilities of petroleum refineries and chemical plants including offsite facilities and pollution control facilities.
- (2) The material selection shall be made on the basis of the following objectives to protect facilities from corrosion problems, especially local corrosion.
 - (a) Minimizing failure
 - (b) Minimizing cost
- (3) The purposes of this standard is to prepare the Material Selection Basis (MSB).

2. WORK PROCEDURE**2.1 Input to The Design****2.1.1 Temperatures and Pressures**

Maximum operating temperatures and pressures of each lines shall be written on Process Flow Diagram(PFD) or MSB (JGS Form).

2.1.2 Corrosive Chemical Compositions

On each line, chemical composition as shown below shall be written on PFD or MSB .

- (1) S (wt%)
- (2) TAN (Total Acid Number in mg KOH/g)
- (3) H₂ (Partial Pressure in psia)
- (4) H₂S (mol% or vol%)
- (5) CO₂ (Partial Pressure in psia)
- (6) H₂O (Dew Point in deg.C or deg. F)
- (7) Cl (Chloride or Chloride ion in wt ppm)
- (8) NaOH (wt%)
- (9) $K_p = \{(H_2S \text{ mol } \%) \times (NH_3 \text{ mol } \%)\}$
- (10) AMINE (MEA, DEA, MDEA, DIPA and others in mol % or wt %)
- (11) Others (HCl, H₂SO₄, HNO₃, NH₄HS, NH₄Cl, CN⁻, NH₄, PHENOL in wt % or wt ppm)

Note : 1) S, H₂, H₂S and H₂O shall be written in any refinery process.
 2) TAN is required for CDU/VDU process, if the TAN value of the feed exceed 0.5 mg KOH/g.
 3) CO₂ partial pressure is required if exceed 3 psia.
 4) AMINE is required if AMINE concentration exceed 1 wt%.
 5) Others are required if necessary.

2.1.3 Corrosion Allowance

Corrosion allowance, expressed in terms of thickness, is a measure of extra thickness with which a material can survive its design life. In this standard, corrosion allowance shall be classified as follows:

- (1) A Grade 0 mm for heat exchanger tube or high corrosion resistance material
- (2) B Grade 1.5 mm
- (3) C Grade 3.0 mm
- (4) D Grade 6.0 mm for replaceable parts

2.1.4 Environmental Conditions

The operating conditions shall be considered as the environmental conditions in selection of material.

- (1) The chemical composition of a fluid shall be expressed in accordance with paragraph 2.1.2.
- (2) Temperature shall be expressed in deg.C or deg.F.
- (3) Pressure shall be expressed in kg/cm²G or psig.

2.2 Output Data

2.2.1 Designation of Materials

The method for indicating "Designation of Materials" shall conform to ASTM standard specifications and Japanese Industrial Standards (JIS), AISI and ACI shall be supplementary applied. However, steel (e.g. C-steel, Cr-Mo, etc.) may be used in cases where the alloy has many kinds of designation. The designation of materials to which none of the above standards do apply shall be indicated by their chemical composition or trade names.

2.3 Work Steps

From the standpoint of corrosion rate and corrosion allowance, materials classified as A Grade or B Grade shown in para 2.1.3 shall be selected. However, in consideration of property of plant, etc. materials classified as C Grade may also be selected.

2.3.1 Application Procedure of QMS

Actual material selections for each process shall conform to QMS.

If the process conditions such as operating temperatures and/or pressures or the amount of corrosive chemicals exceed the limited values shown on QMS, consult with Materials Engineering Department.

If the Client or Process Licensor specify the materials for each equipment and line, this work will be waived.

3. DESIGN

3.1 Design Consideration

3.1.1 Design Life (Minimum expected life)

In this standard, Design life or Minimum expected life of each facility are specified as follows.

- | | |
|-----------------------|-----------------|
| (1) Reactor | Min. 20 YEARS |
| (2) Tower | Min. 20 YEARS |
| (3) Vessel | Min. 10 YEARS |
| (4) Piping | Min. 5-10 YEARS |
| (5) H/E Tube | Min. 5 YEARS |
| (6) Fired heater tube | Min. 10 YEARS |

3.1.2 Maximum Operating Conditions

Material selections shall be based on maximum operating conditions (Temperatures, Pressures, the amount of corrosive chemicals) of design. If the process conditions are defined as End of Run (EOR), Middle of Run (MOR) and Start of Run (SOR), materials selection shall be conducted on MOR except in case of hydrogen attack. Material selection to prevent hydrogen attack shall be based on the maximum operating conditions. For the calculation of partial pressures for such as H₂, CO₂, H₂O and for K_p, maximum operating pressure shall be used.

3.2 Material Selection Chart by API 941 and NACE MR0175

(1) API 941

To prevent hydrogen attack in high temperature and pressure hydrogen services, materials selection shall conform to API 941 (see Fig. 3.2a).

Note: 1) API 941 will be revised every 3 to 5 years.

2) If the environment (temperature and hydrogen partial pressure) is on a border line in the selection chart of API 941, the higher material shall be selected.