Selection Consideration of NDE in oil and gas

In the selection of a suitable NDE, welding technologists, material manufacturers, and NDE experts should be involved

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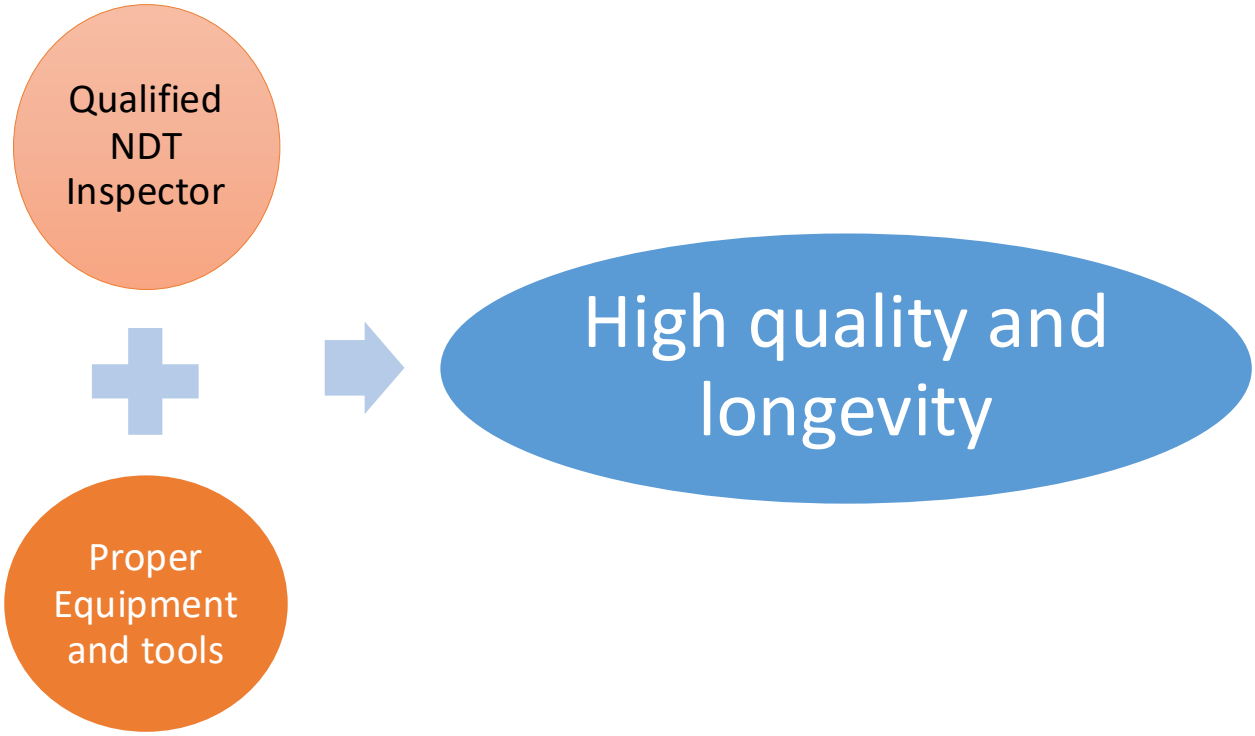

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Introduction

- Non-Destructive Examination (NDE) procedures are critical in the oil and gas sector for guaranteeing the integrity, safety, and reliability of equipment and infrastructure while avoiding damage.
- NDE helps to prevent accidents, failures, and leaks.
- NDE can determine faults, abnormalities, and deterioration in equipment and structures.
- NDE helps detect and assess both internal and external flaws with pipelines, pressure vessels, and other equipment.
- The cost-saving advantages of NDE by reducing unplanned downtime and maintenance expenses

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Factors Influencing NDE Selection

- Material type
- Component size and geometry
- Inspection requirements (surface, subsurface, internal)
- Objectives of the inspection outcomes
- Environmental conditions (temperature, pressure, corrosion)
- Codes or company requirements
- Timeframe

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Applications in the oil and gas industry

- Pipelines and Piping Systems
- Pressure Vessels
- Storage Tanks
- Weld Inspection
- Corrosion Monitoring
- Structural Integrity Assessment
- Materials Characterization

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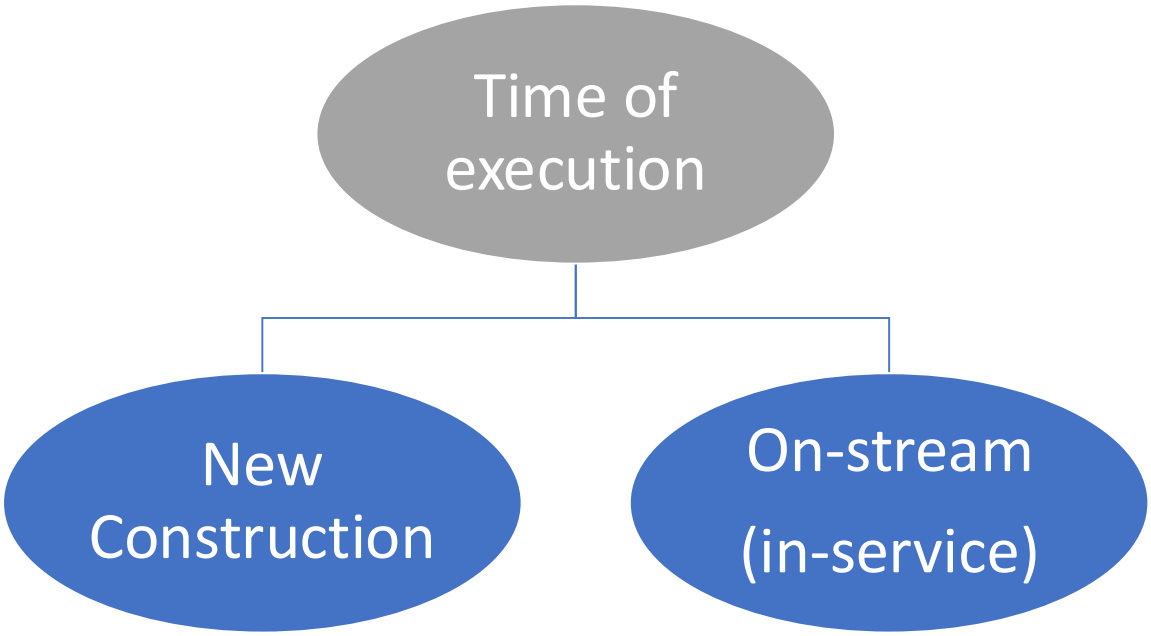

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New Construction

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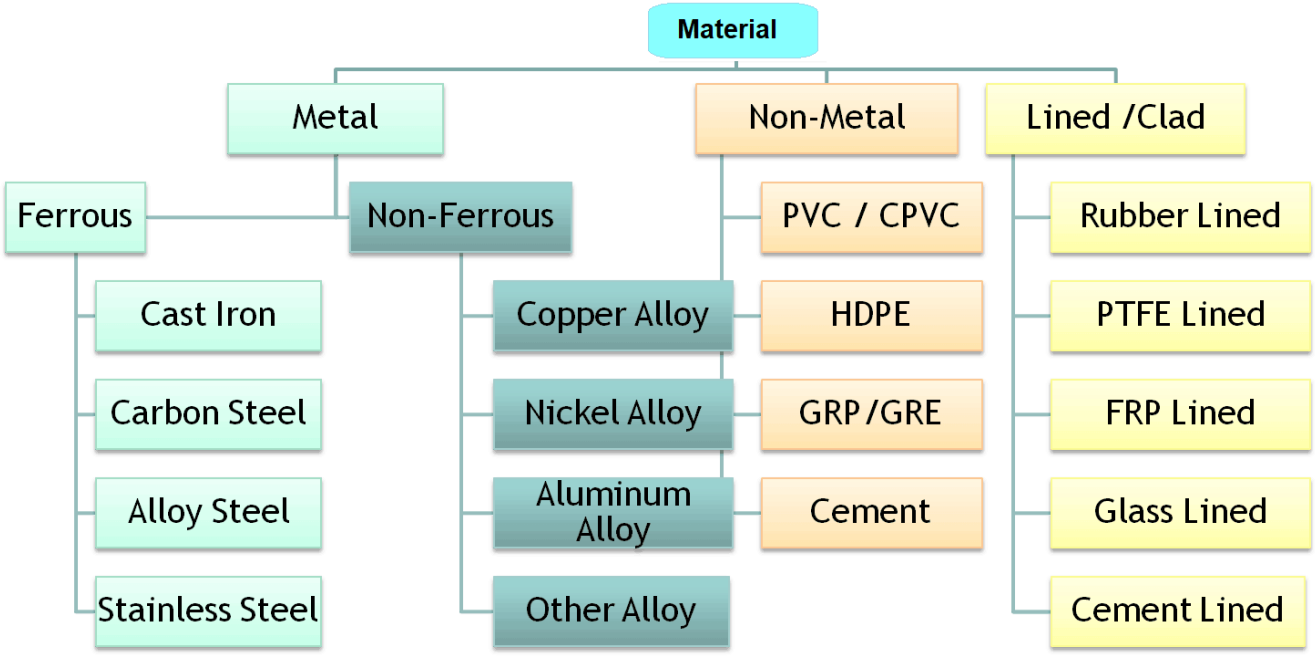
New Construction consideration
Material type



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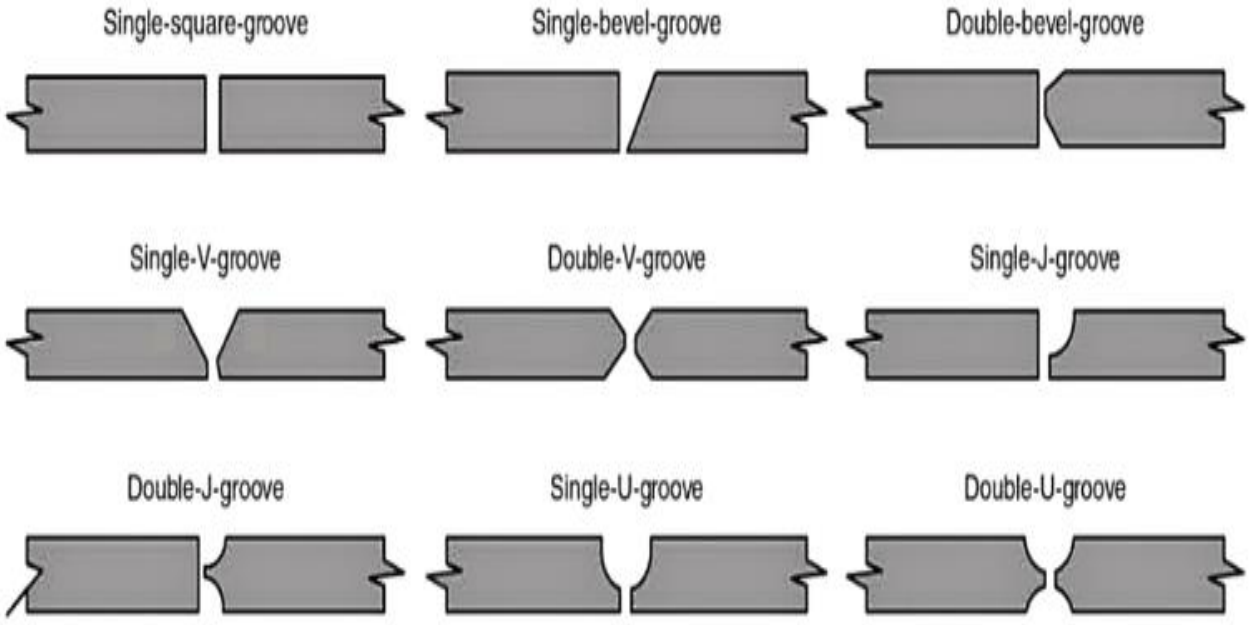
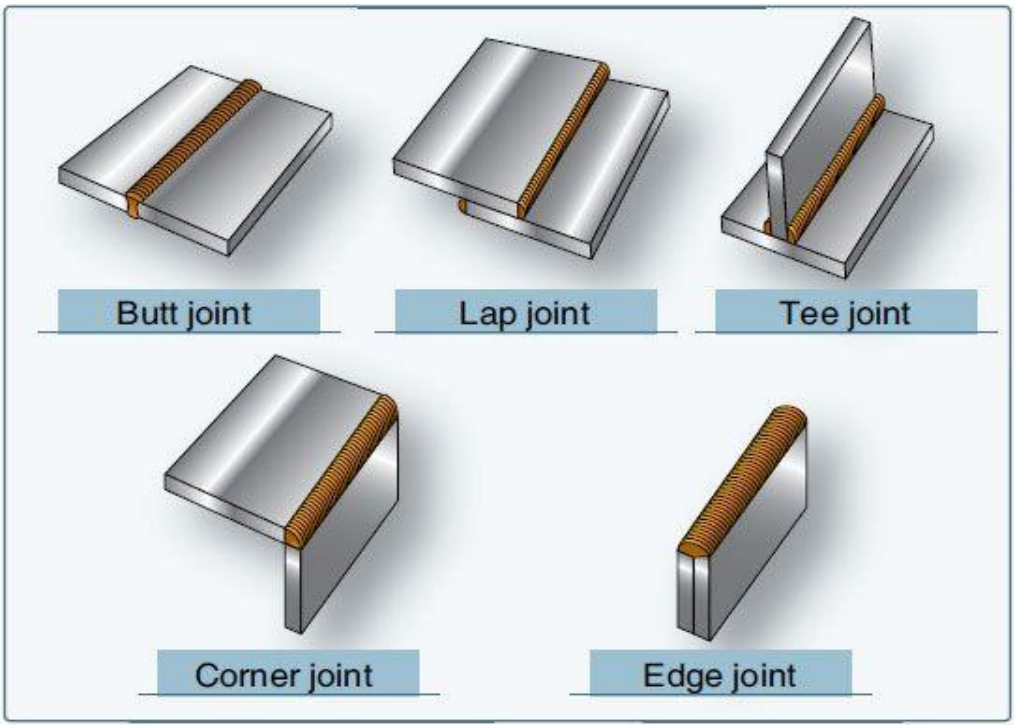
New Construction consideration
Weld design



New Construction consideration
Joint type



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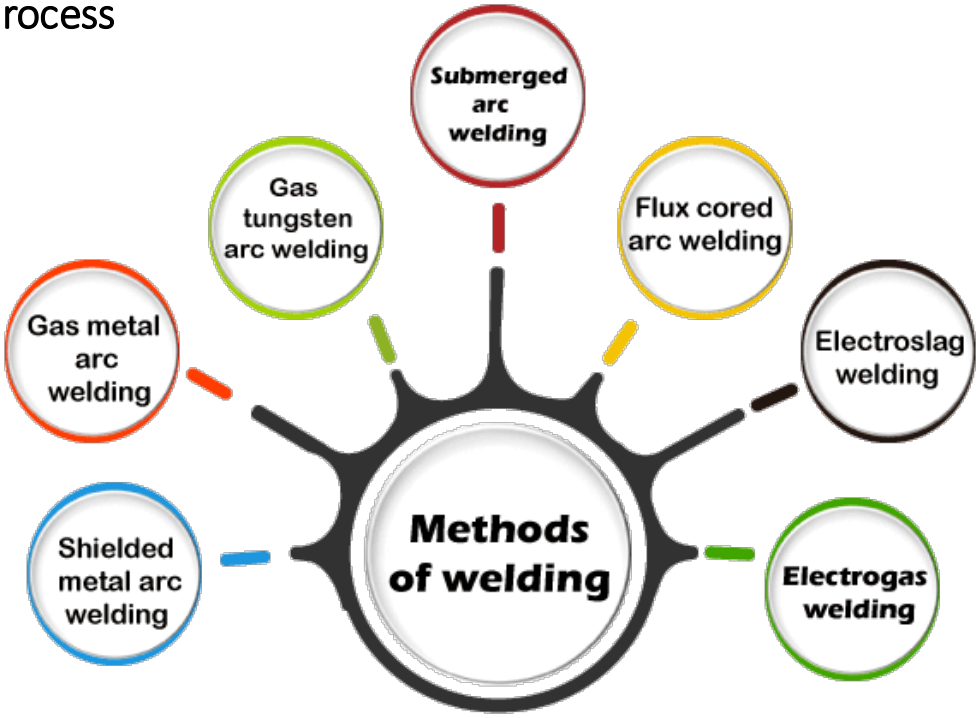
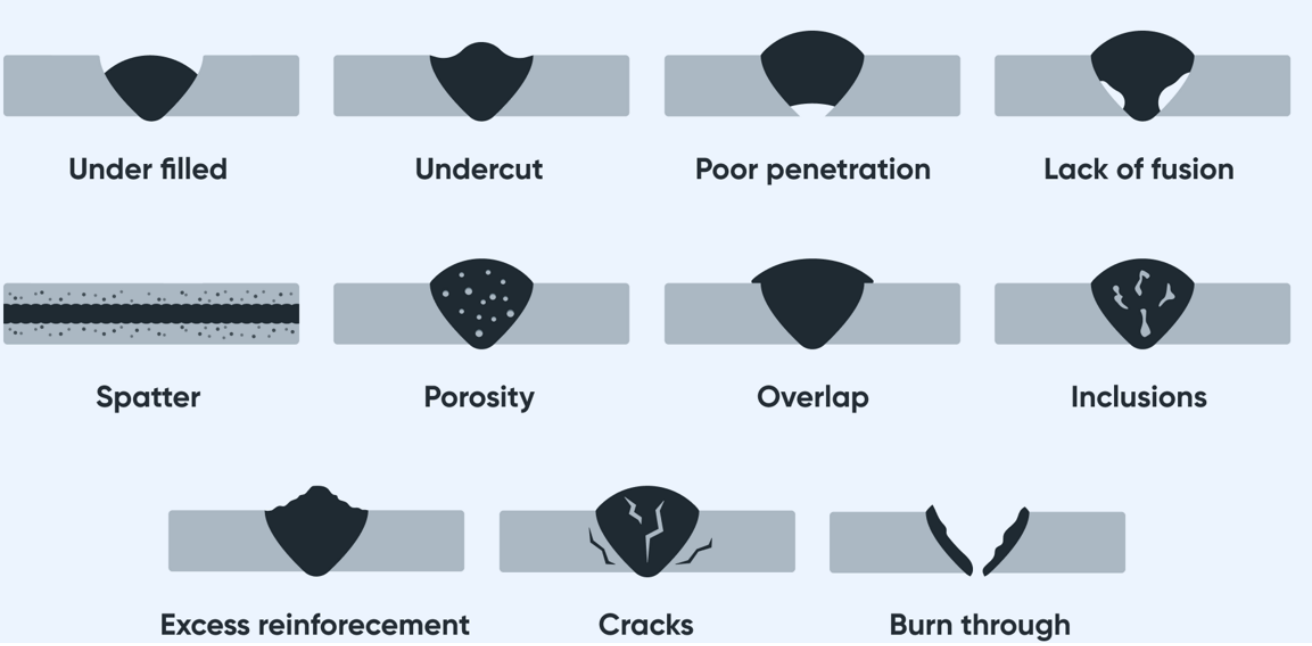
New Construction consideration
Welding process



New Construction consideration
Detects



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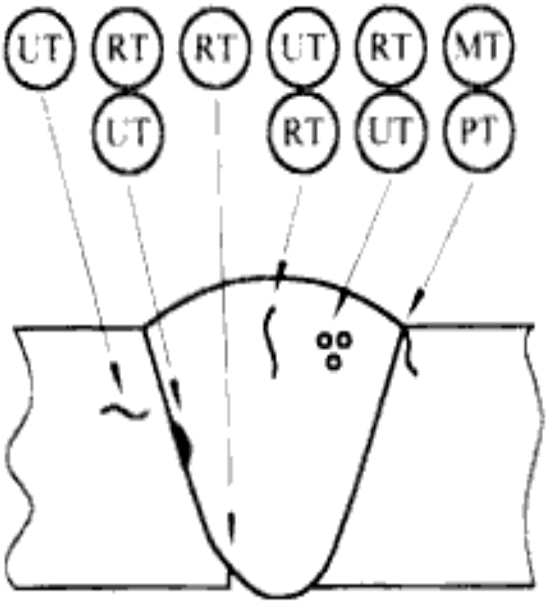
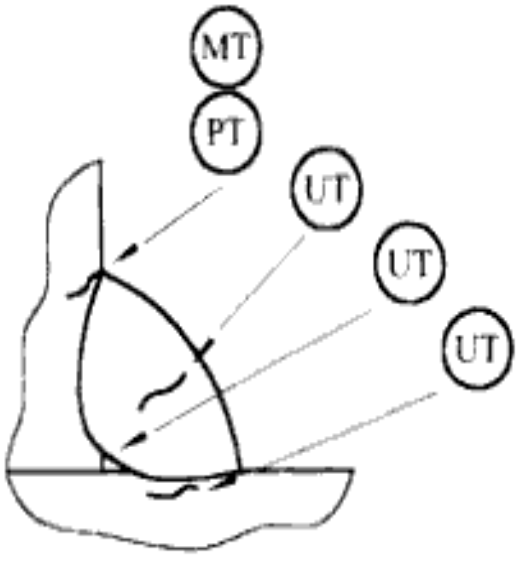
New Construction consideration
Methods capability





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Example

We assume that there are 100 welds CS of pipe 24 inches with a thickness of 50 mm

Required to do volumetric and surface test

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Radiographic test

Source activity = 40 Cu

circumference

24*3.14*25.4 =1920 mm

Number of films

1920mm \ 480 mm = 5 films

Films exposure time

5 film * 11 min = 55 minutes per joint ~ 1 hour

Time for 100 joints

1 hour * 100 joints = 100 hour \8h shift = 12.5 shift

Development, evaluation, reporting , reshoot and repair

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Phased array ultrasonic test

circumference

24*3.14*25.4 =1920 mm + 10 % overlap

Joint time for both sides

10 min per joint

Time for 100 joints

10 min * 100 joints = 17h \8h shift = 2.25 shift

evaluation and reporting

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In- service

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Introduction

- Refineries and chemical plants contain many different processing units, each having its own combination of aggressive process streams and temperature/pressure conditions.
- API 571 is a recommended practice (RP) that discusses a total of 67 damage mechanisms that are applicable to oil refineries, petrochemicals, and other industrial applications.

1. Identification of existing or future damage and anticipated rates of degradation
2. Development of inspection and monitoring plans
3. Implementation and monitoring of integrity operating windows (IOWs)
4. Development of corrosion control documents (CCDs)
5. Implementation of Risk-Based Inspection (RBI) programs
6. Conducting Fitness-For-Service(FFS) assessments

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- Fitness-For-Service (FFS) assessments are quantitative engineering evaluations that are performed to demonstrate the structural integrity of an in-service component containing a flaw or damage.
- The first step in a fitness-for-service assessment performed in accordance with API 579-1/ASME FFS-1 is to identify the flaw type and the cause of damage. Proper identification of damage mechanisms for components containing flaws or other forms of deterioration is also the first step in performing a Risk-Based Inspection (RBI) in accordance with API RP 580.

Factors Influencing NDE Selection

- Description of the damage mechanism.
- Affected Materials
- Critical Factors affect the damage mechanism.
- Affected Units or Equipment
- Appearance or Morphology of Damage
- Prevention/ Mitigation
- Inspection and Monitoring: (NDE)

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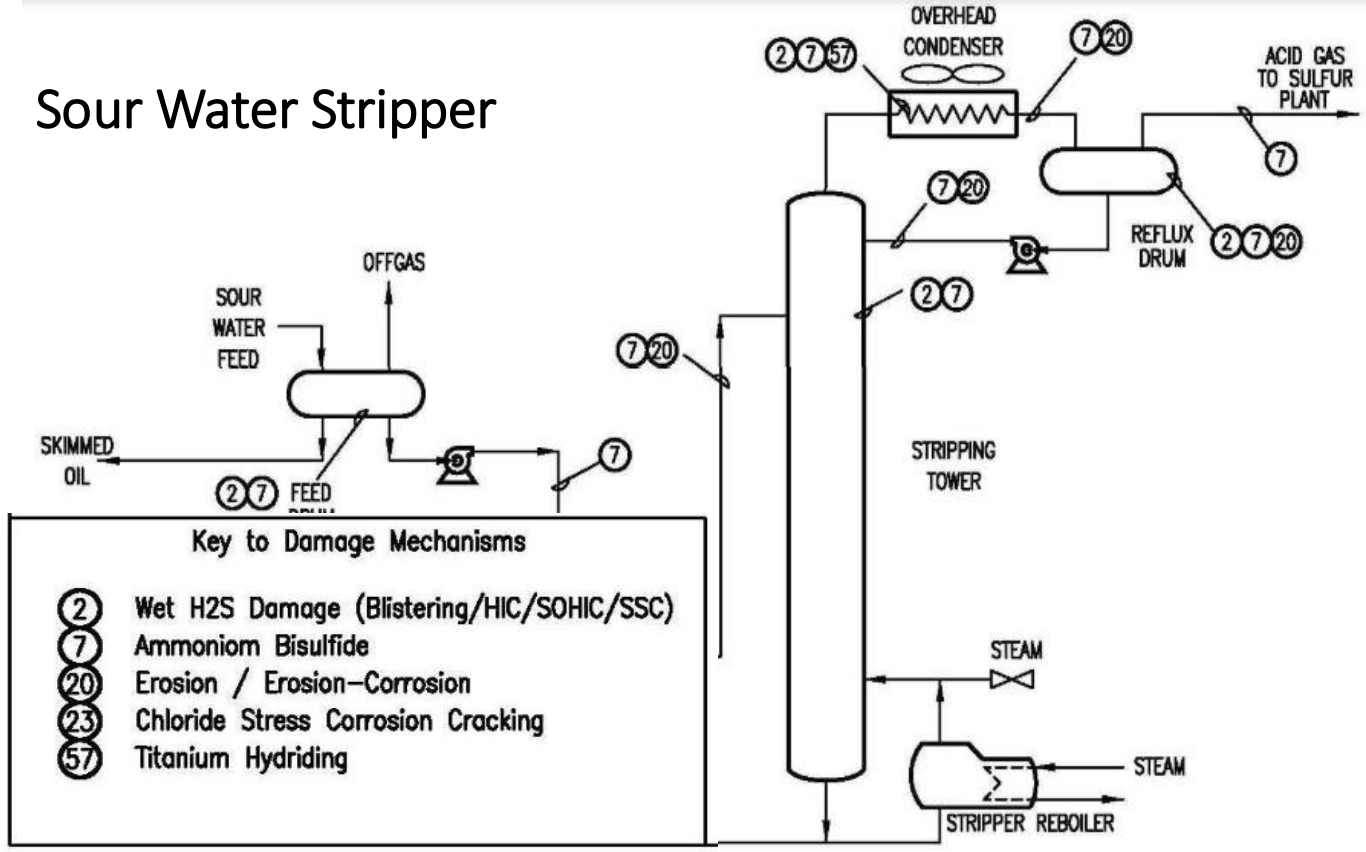
Sour Water Stripper



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Ammonium Bisulfide Corrosion (Alkaline Sour Water)

- Nitrogen in the feed is converted to ammonia (NH3) and reacts with hydrogen sulfide (H2S) to form ammonium bisulfide (NH4HS)

Affected Materials

- Carbon steel is less resistant.
- 300 Series SS, duplex SS, aluminum alloys and nickel base alloys are more resistant, depending on ammonium bisulfide (NH4HS) concentration and velocity

Affected Units or Equipment

- Air cooler
- Exchanger
- Piping
- Drums

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Inspection and Monitoring

- UT scanning and/or RT profile thickness of high and low velocity areas
- UT at high NH4HS concentrations.
- IRIS, RFT and flux leakage inspection of steel
- ECT inspect non-magnetic tubes.

When considering cost efficiency in selecting NDT techniques

- Initial Equipment and Setup Costs
- Operating Costs
- Inspection Time
- Detection Sensitivity and Accuracy
- Risk Reduction
- Return on Investment (ROI)
- Scalability and Flexibility

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Conclusion

- Selection Process for NDE Methods
- Assessing the inspection requirements
- Considering the factors discussed earlier
- Conducting feasibility studies and cost analysis

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Thank you

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