Society for Underwater Technology Middle East Branch

Emergency Pipeline Repair Systems (EPRS)

An overview of the tools and methods available for the on-bottom repair of rigid pipelines

Tuesday 13 December 2022

09:00 - 15:30 at Khalifa University, SAN Campus and Dolphin Energy KIZAD

Presenters: Mr. Russel Harper & Mr. Earl Toup, Managing Director & Hyperbaric Welding & NDT Manager

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Welded Solutions

Hyperbaric Pipeline Repairs – DCN Diving

EUR ING Earl L. Toups *MSc CENG CIWE*

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Agenda

- Introduction & Background
- Damage Characterization
- Main Equipment Overview
- Hyperbaric Welding Procedure Qualifications
- Non-Destructive Testing
- In-Service Welding Criteria & Considerations
- Case Study – Live 32” Gas Pipeline Repair
- Hyperbaric Pipeline Repair Technological Developments
- Questions

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Introduction & Background

Hyperbaric welding is the process of welding at elevated pressures, normally underwater.

Hyperbaric dry welding takes place inside a specially constructed positive pressure enclosure, often referred to as a Habitat.

The first hyperbaric weld made was made in the late 1960’s in Brazil.

Welding processes: GTAW, SMAW, GMAW & FCAW

Water depths up 400 msw.

Produces a high-quality permanent repair.

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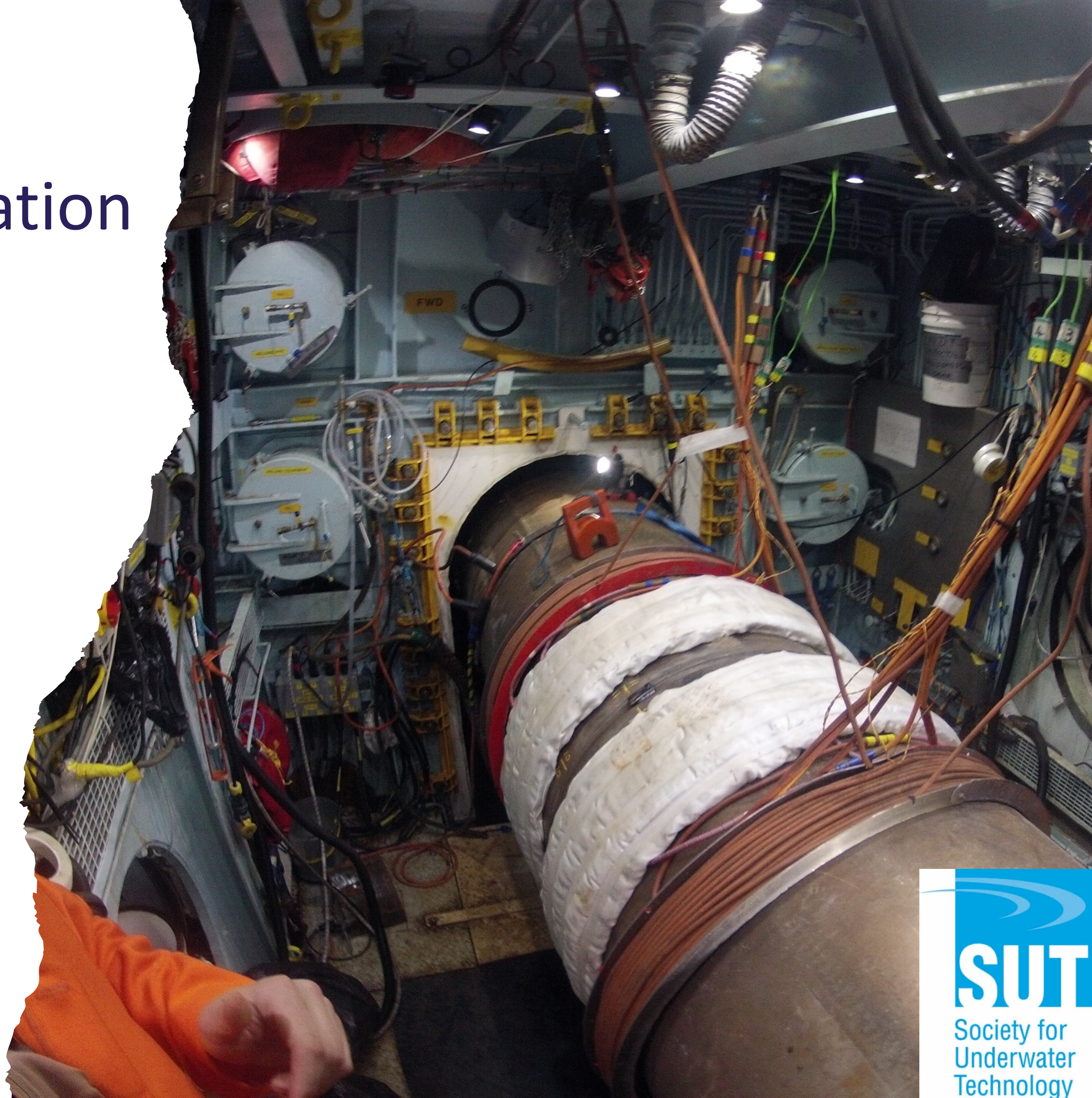
Damage Characterization

- **What is the water depth?**

- **How bad is the damage?**
  - Minor
  - Major Singular
  - Major Multiple

- **Is there loss of containment?**
  - No
  - Yes (Minor or Major)



Habitats

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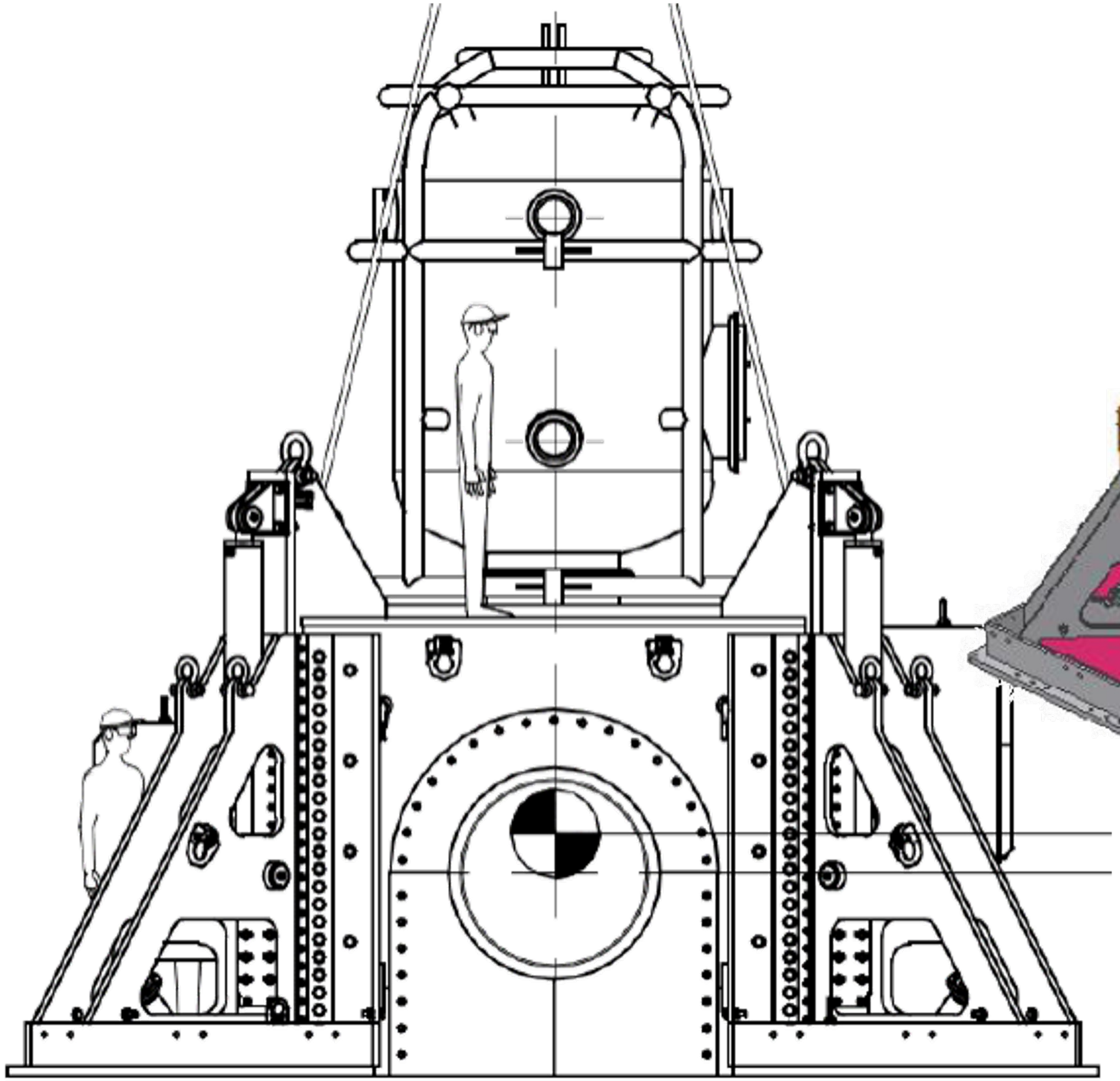
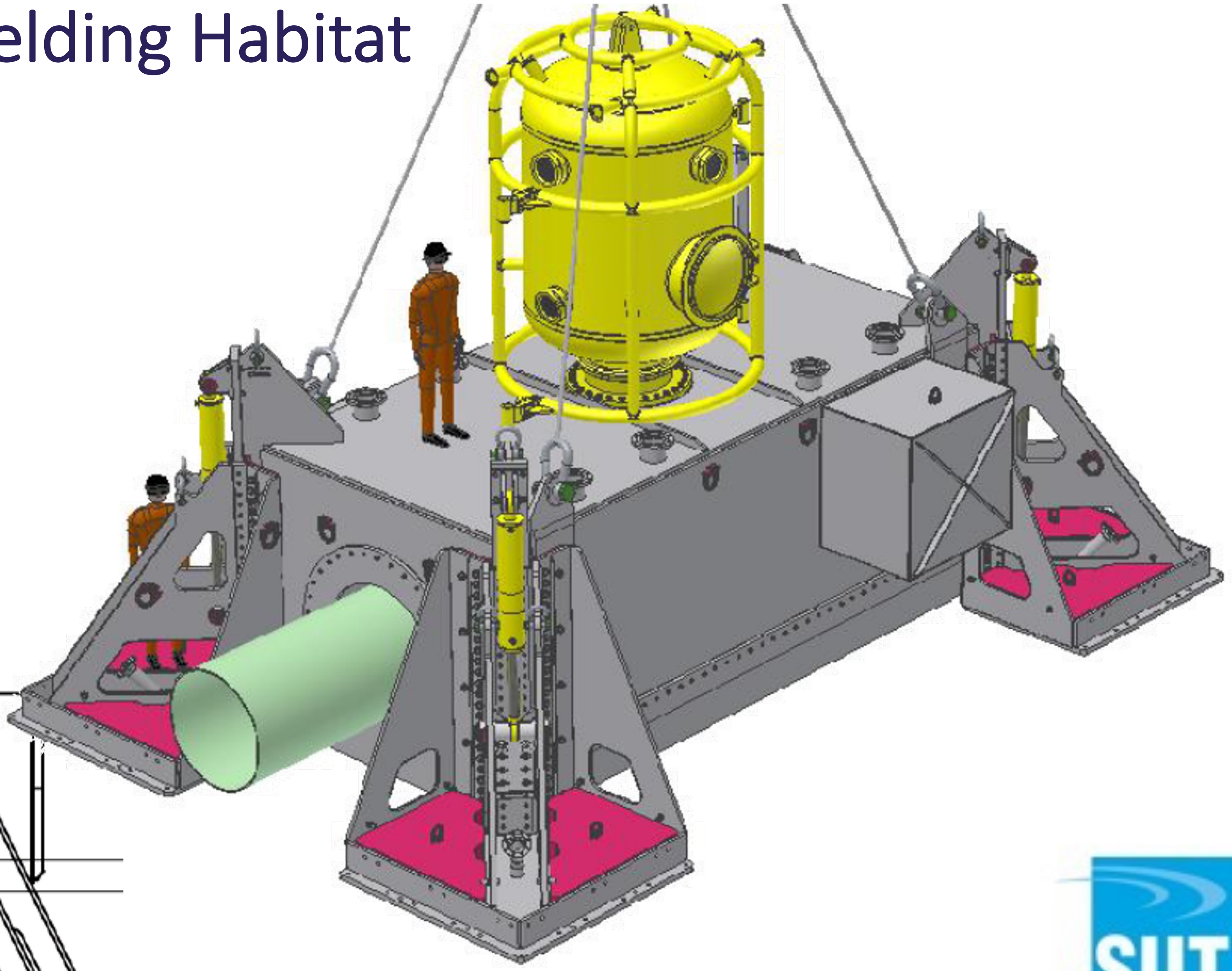
Hyperbaric Welding Habitat





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Ancillary Equipment

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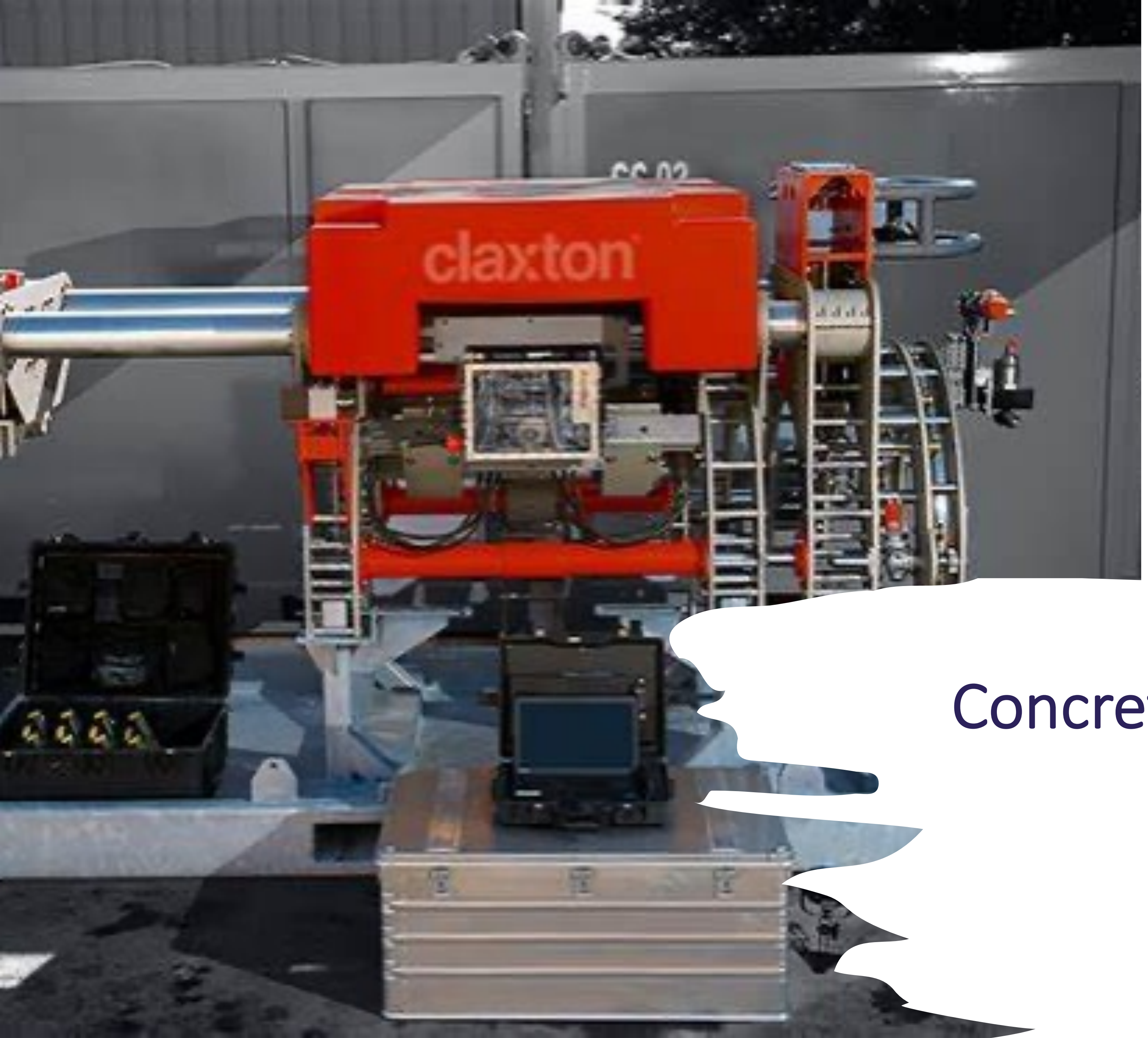

Concrete Coating Removal Equipment

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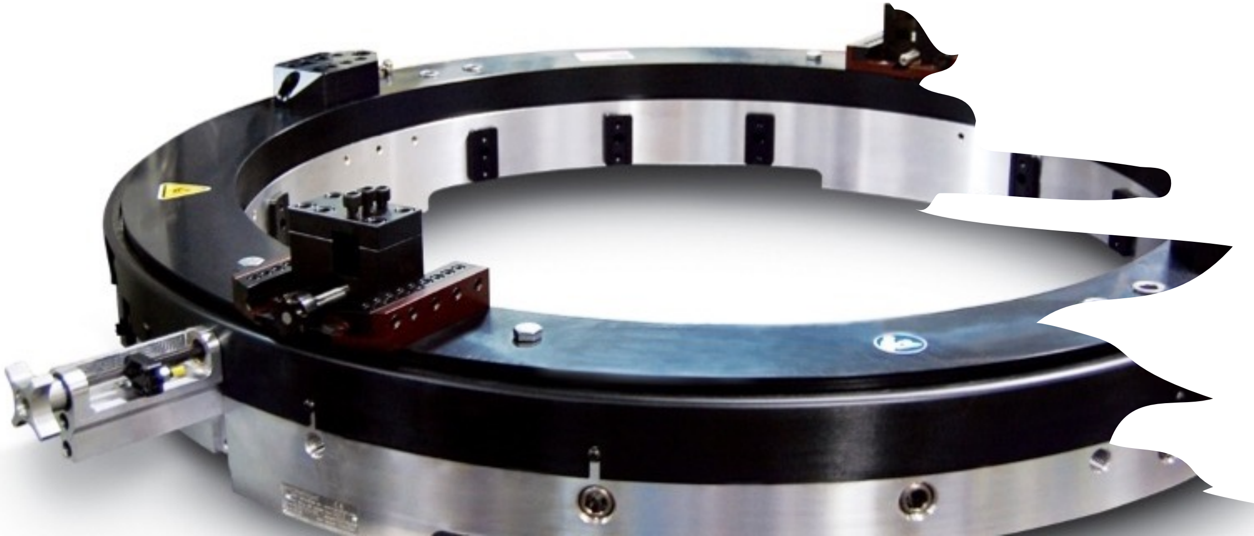

Cutting & Beveling Equipment

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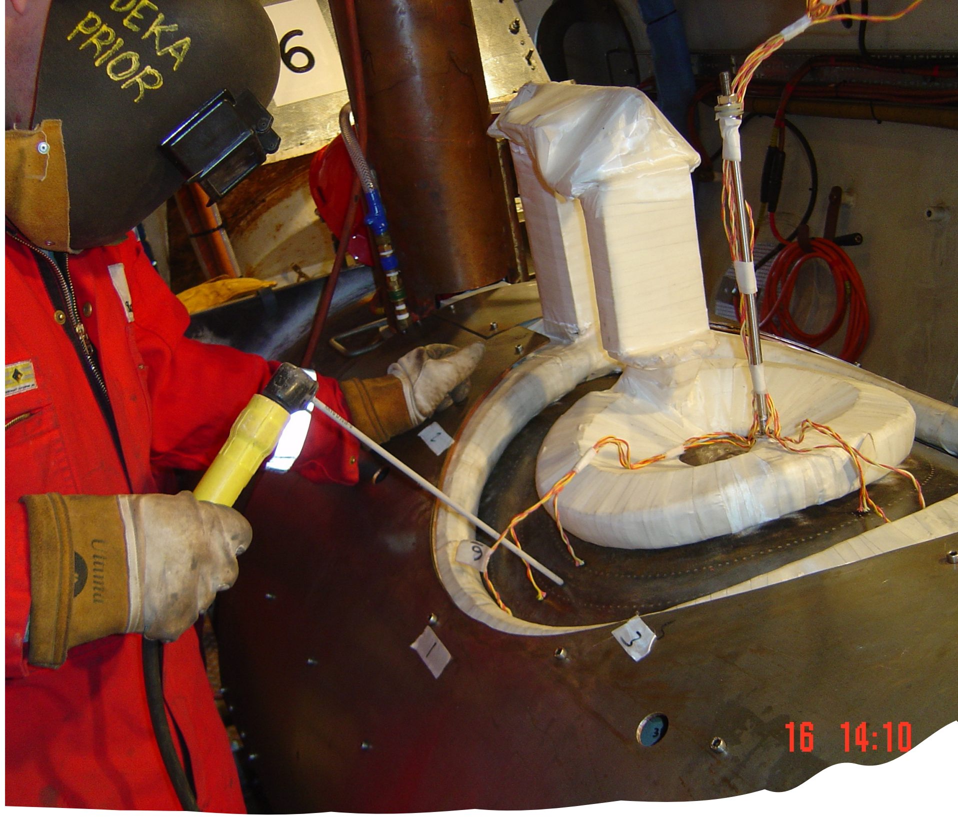

Preheating Equipment

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Hyperbaric Test Center

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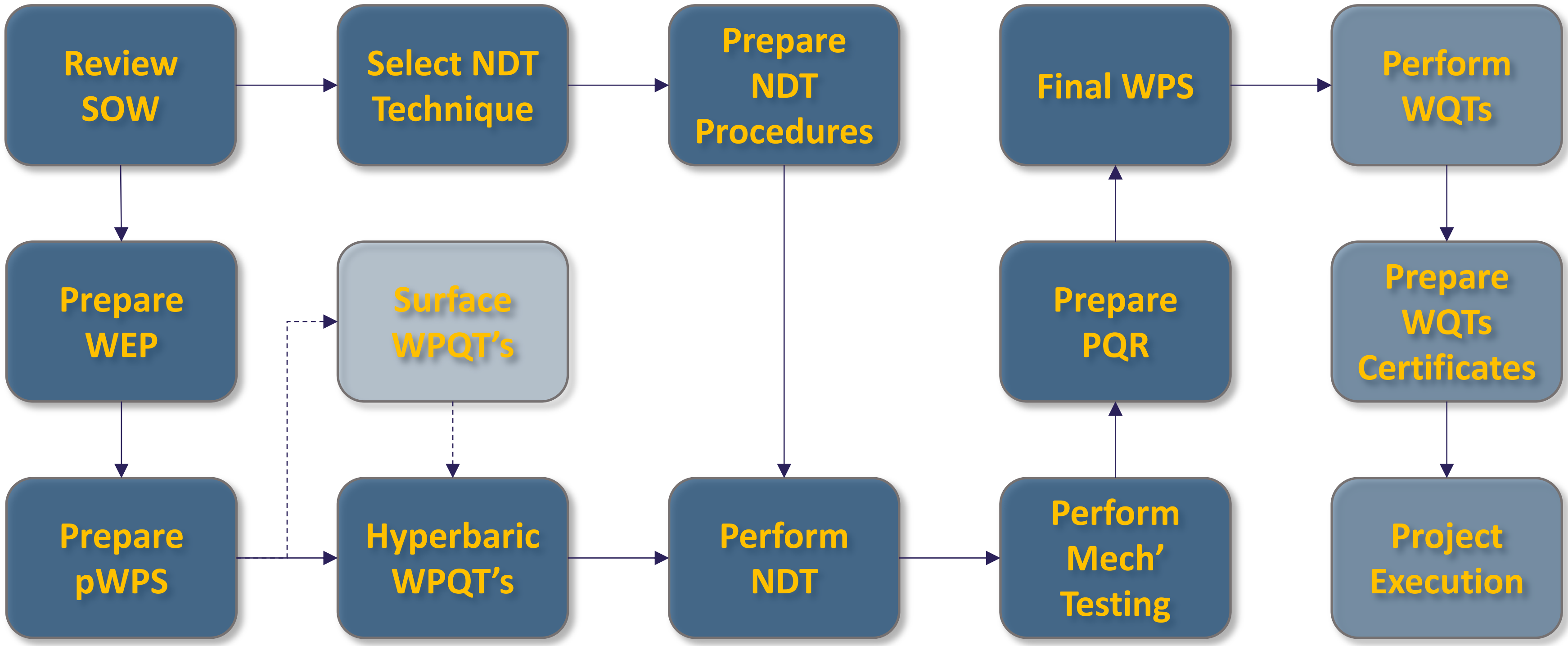
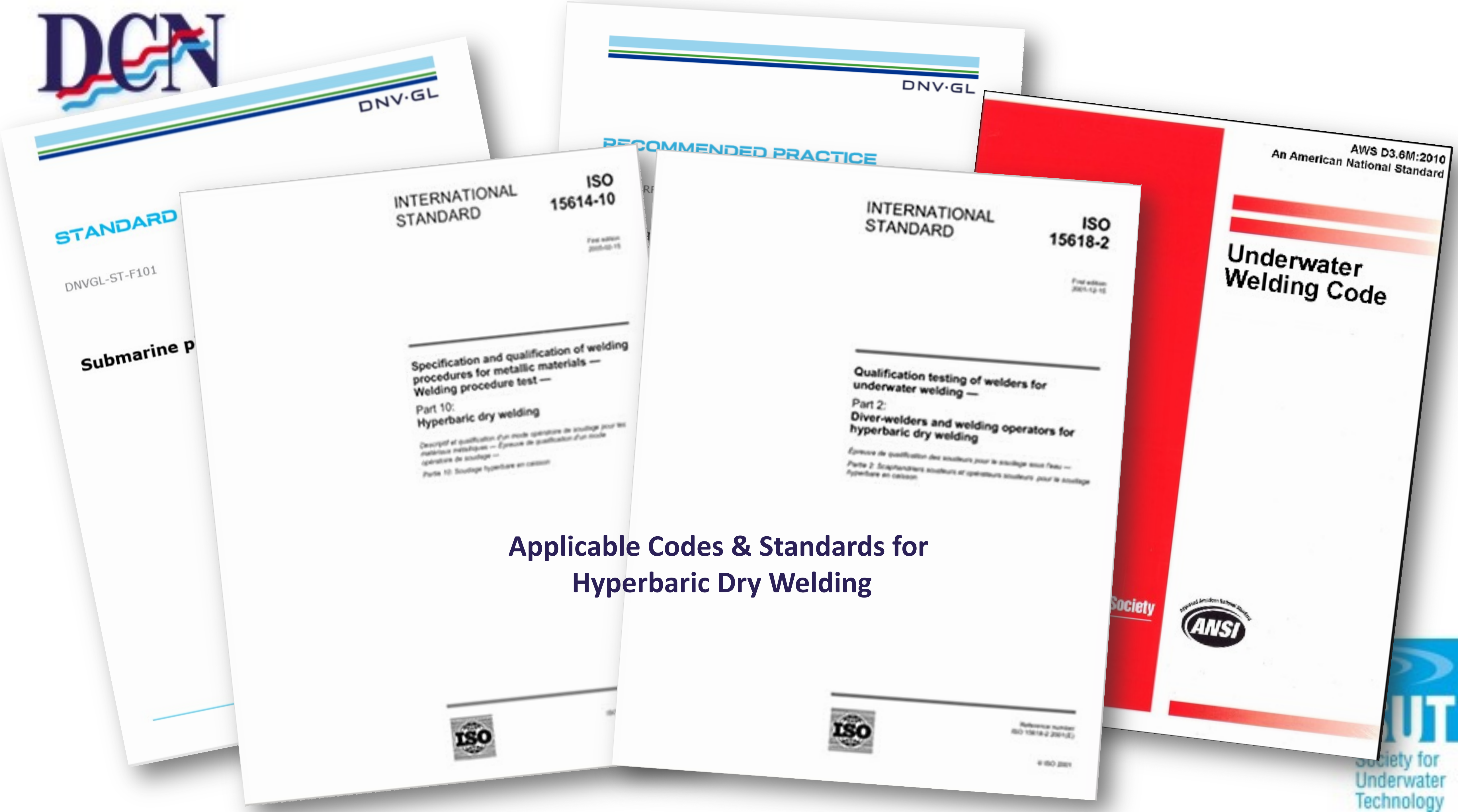
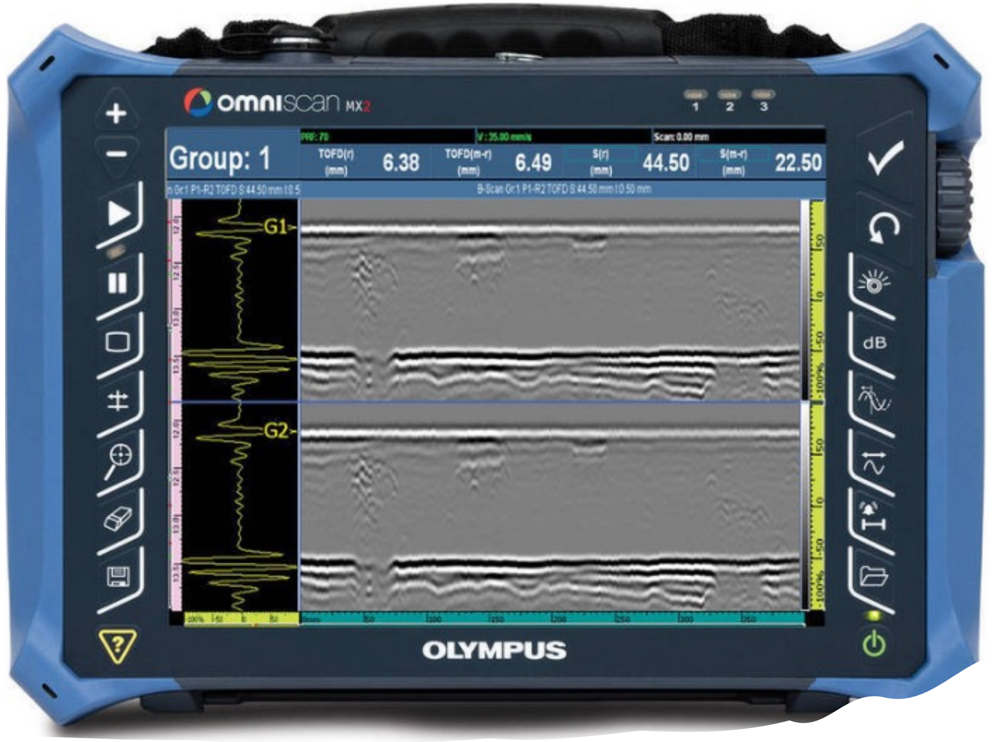
Hyperbaric Welding Procedure Qualification Testing

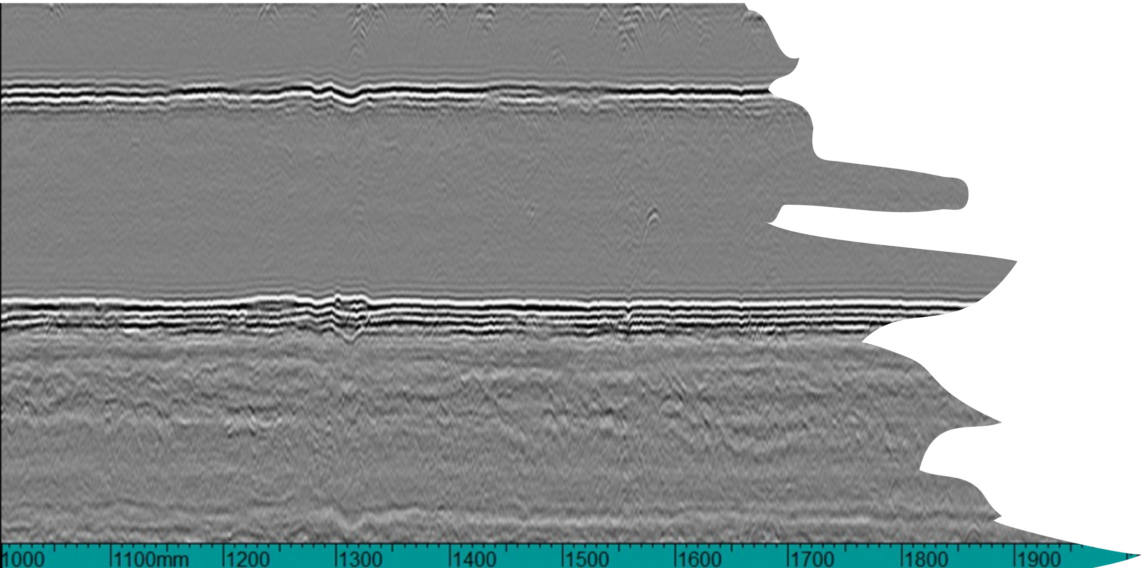


Hyperbaric Welding Procedure Qualification Process

Applicable Codes & Standards for Hyperbaric Dry Welding







Non-Destructive Testing

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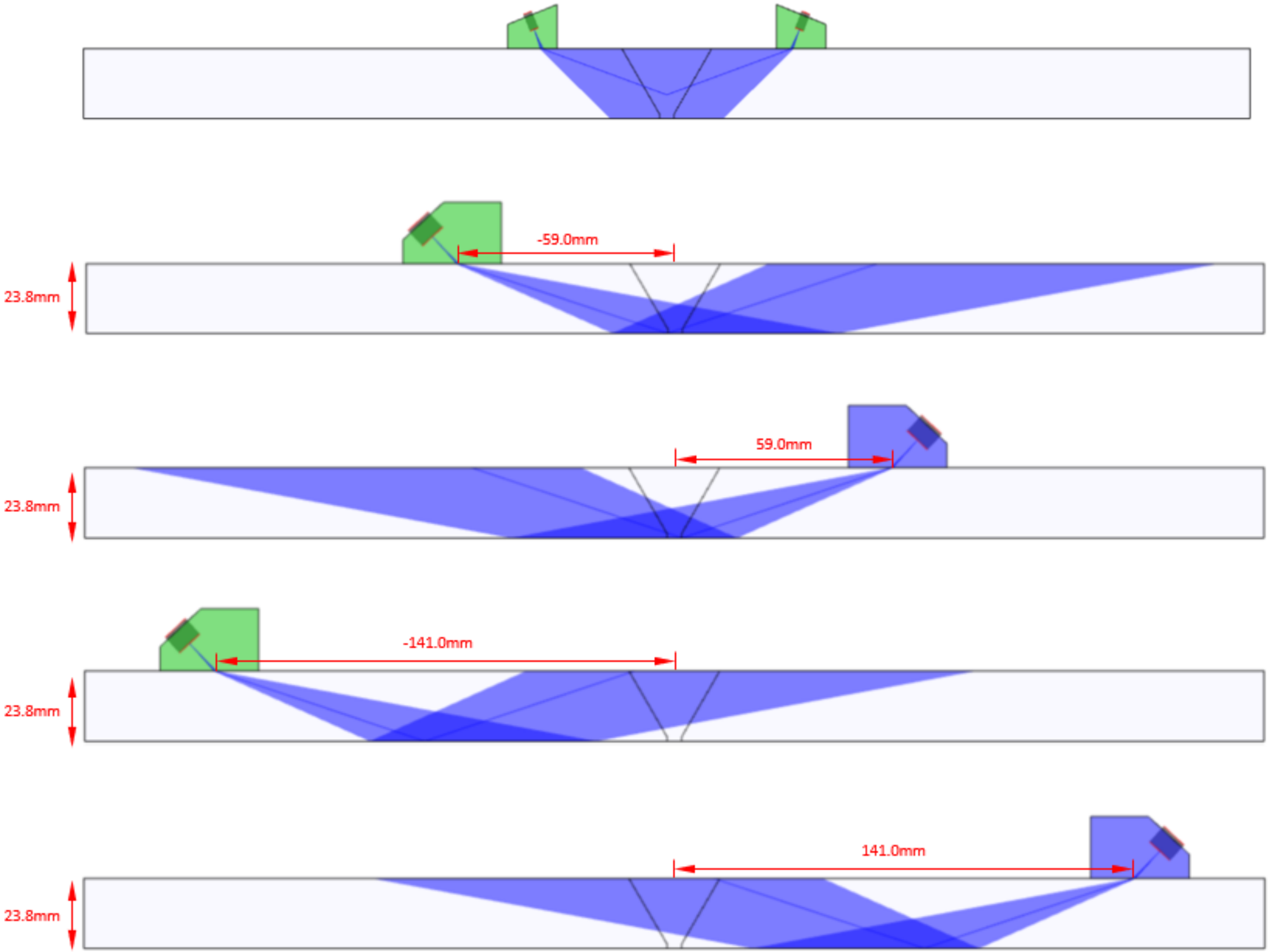

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In-Service Welding Criteria & Considerations

No.	Service Condition			WPQT	Risks
	Flow	Pressure	Contents		
C1	Yes	Yes	Crude[1]	With internal flow / forced cooling	Hydrogen-induced cold cracking
C2	No	Yes	Crude[1]	No internal flow / forced cooling internal[2]	Internal fire if O_2 present
C3	No	No	Crude	Covered by C2	Internal fire if O_2 present
C4	No	No	Decruded	Covered by C2	-

[1] Maximum permitted pipeline pressure during in-service welding to be determined in accordance with COMPANY requirements.

[2] Thermocouples are to be placed on the carrier pipe ID to determine the maximum internal skin temperature during welding.

Possible Pipeline Service Conditions

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HWPQTs with Internal Forced Cooling

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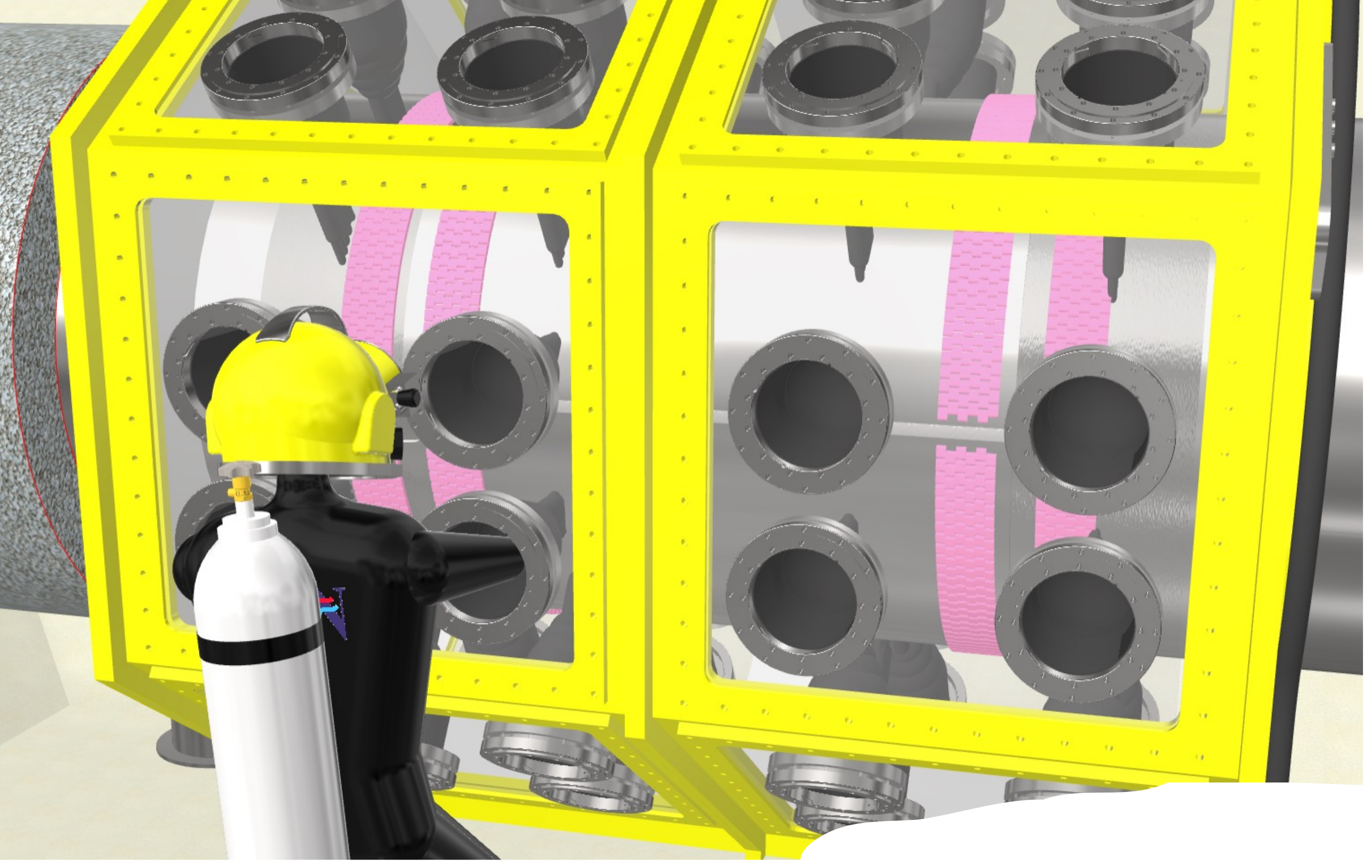
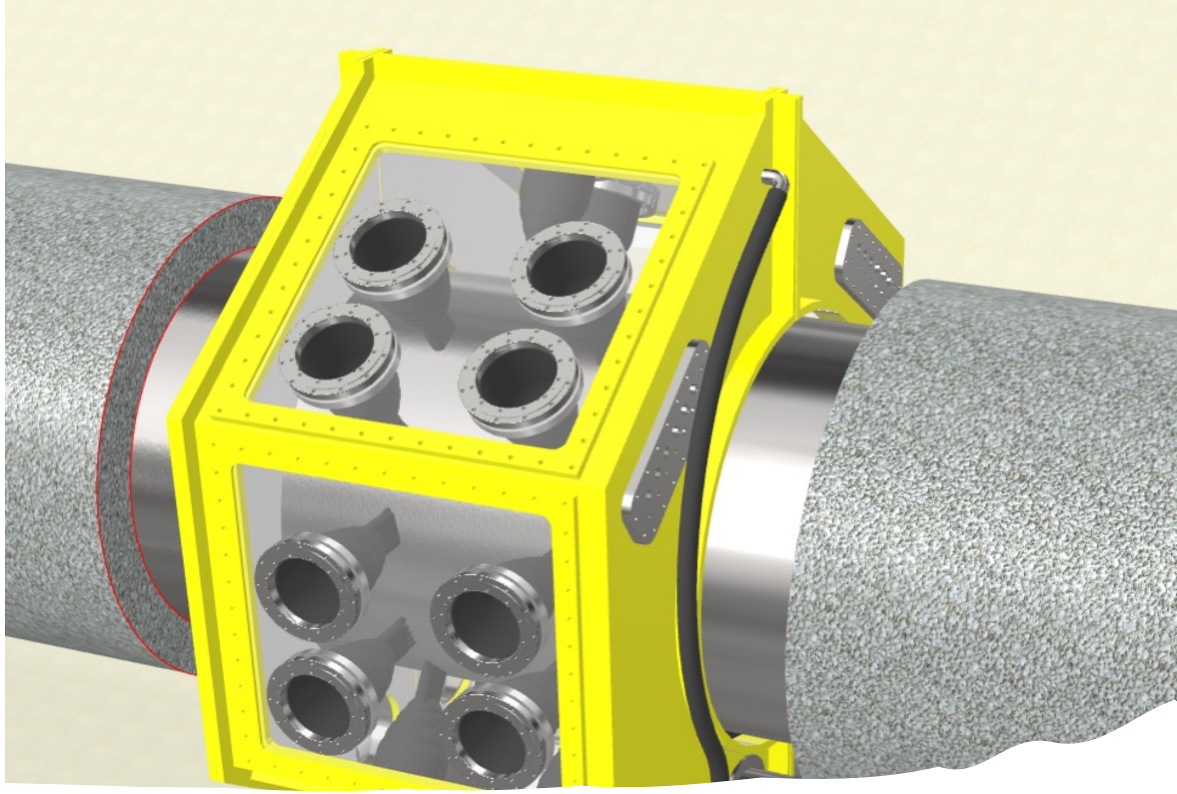
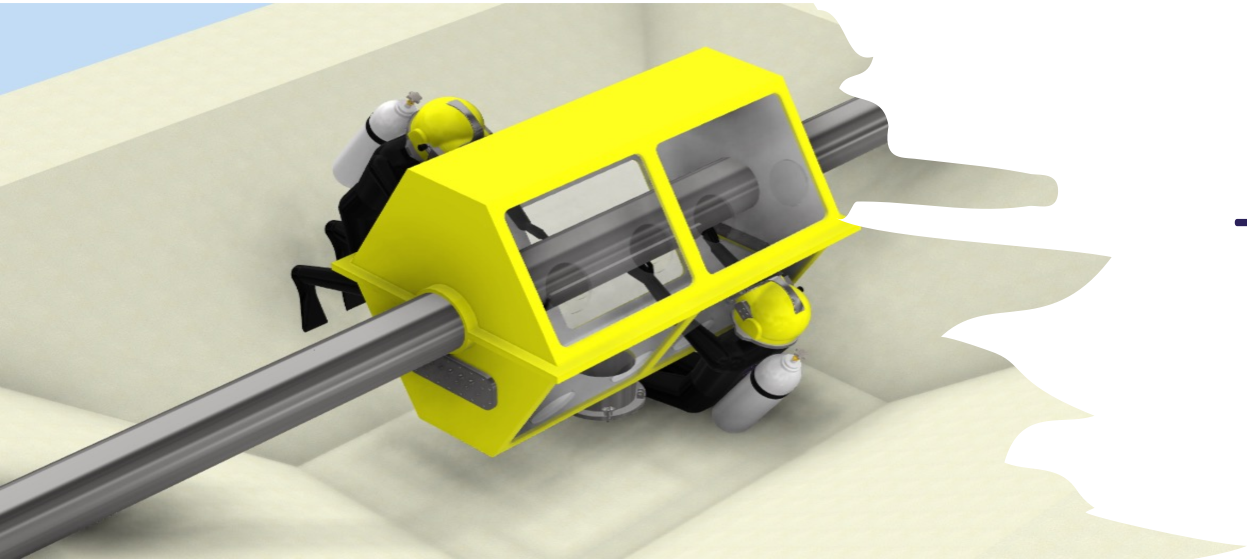
29 Million People
SUMATRA ISLAND
JAVA ISLAND
Jakarta







Hyperbaric Welding Technological Developments

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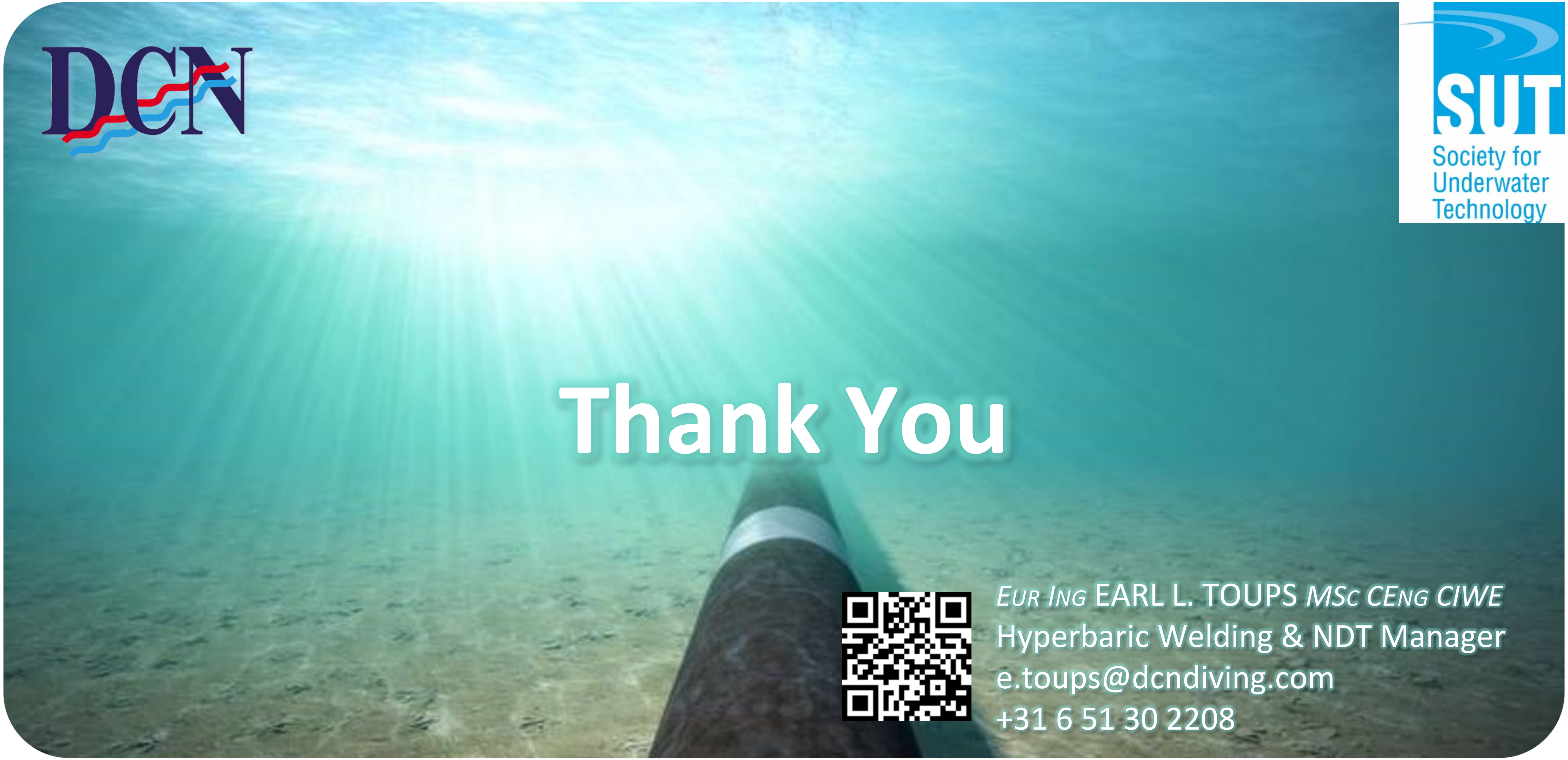
"What is on the bottom, is on the bottom!"

This is why it is important to bring the correct and best materials to the job!

- Grade and delivery condition of the steel i.e. TMCP steels are preferred.
- Welding Process Selection
- Welding Consumables
- Welding Equipment
- Ancillary Welding Equipment

Give yourself the best chance of success!



Thank You

Eur Ing EARL L. TOUPS *MSc CEng CIWE*
Hyperbaric Welding & NDT Manager
e.toups@dcndiving.com
+31 6 51 30 2208

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