



EXPRESS
ENGINEERING
SOLUTIONS

PRESSURE VESSEL DESIGN

**AS PER ASME SEC
VIII DIV 2**



No one can de-code the code like us...!



91 9921229232 / +91 7500507040



training@express-engg.com

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1

Pressure Vessel Design

(84 hrs)

Lecture No	Topics CLICK ON TOPICS FOR DETAILS	Hours (hrs)
1	Introduction	8
2	Material Requirements (Part-3)	5
3	Impact Testing	5
4	Internal Pressure Calculations	7
5	External pressure Calculations	7
6	Design-by-rules (Part 4)	12
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11	Wind , Seismic and Combine Loading	9
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Pressure Vessel Design (DIV 2)

1

Introduction

(8 hrs)

- Understanding ASME BPV Code
- Why ASME Section VIII Div-2?
- ASME Section VIII Div-1 Vs ASME Section VIII Div-2 - Key Differences
- 1.1.2 - Structure of ASME Section VIII Div-2
- Annex 1-B - Important code definitions
- 1.1- ASME Section VIII Div-2 - Scope & limitations
- ASME Section VIII Div-2 - Class 1 vs Class 2
- Part 2- The Designer, The Engineer & The Certifying Engineer
- 2.2.3 - User's Design Specifications (UDS) & Manufacturer's Design Report (MDER) - Contents & Certification
- Annex-3A, ASME Section II Part D , Factor of safety
- Table 1.1 : Year of Acceptable Edition of Referenced Standards in This Division
- Figure 4.2.1 - Categories of weld Joints
- Part 7 - Table 7.1 - Joint Efficiency & Examination Group as per

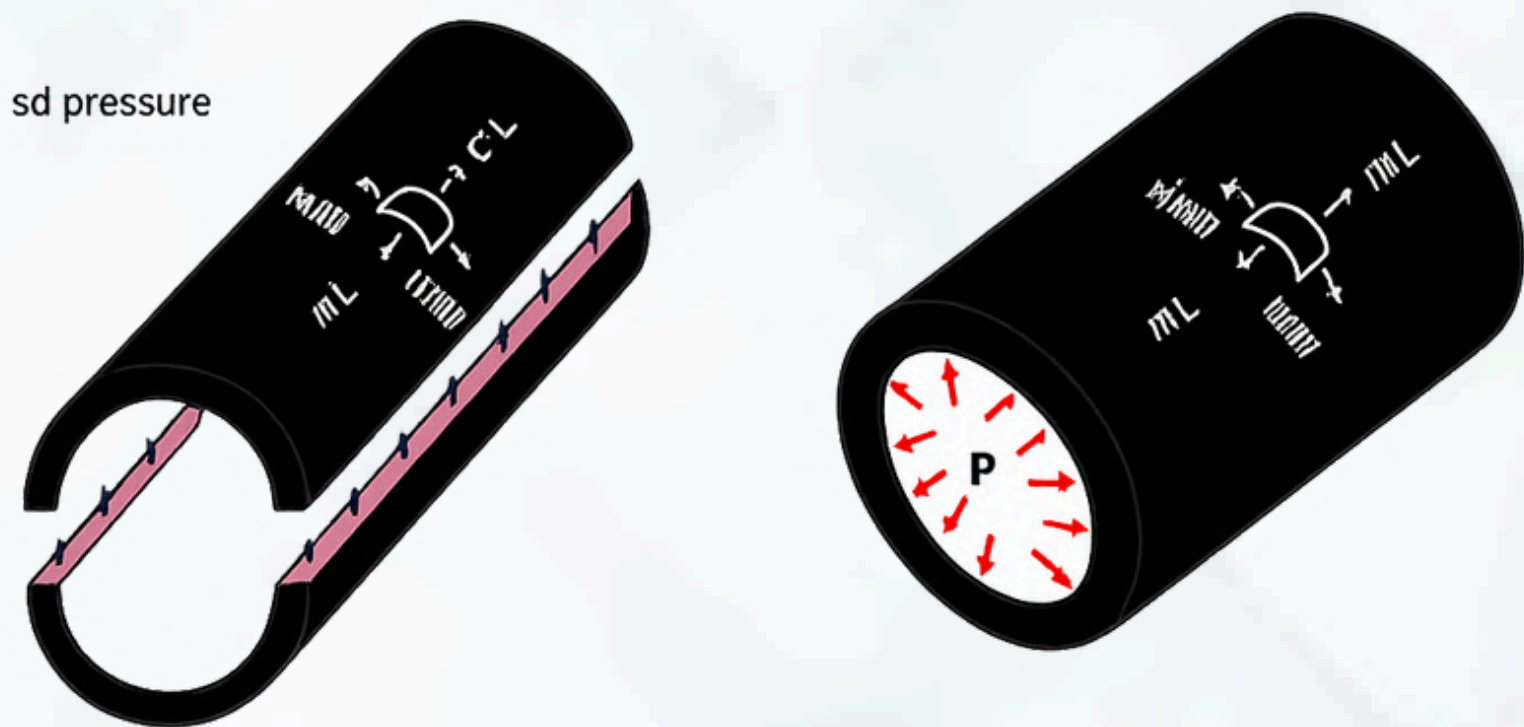
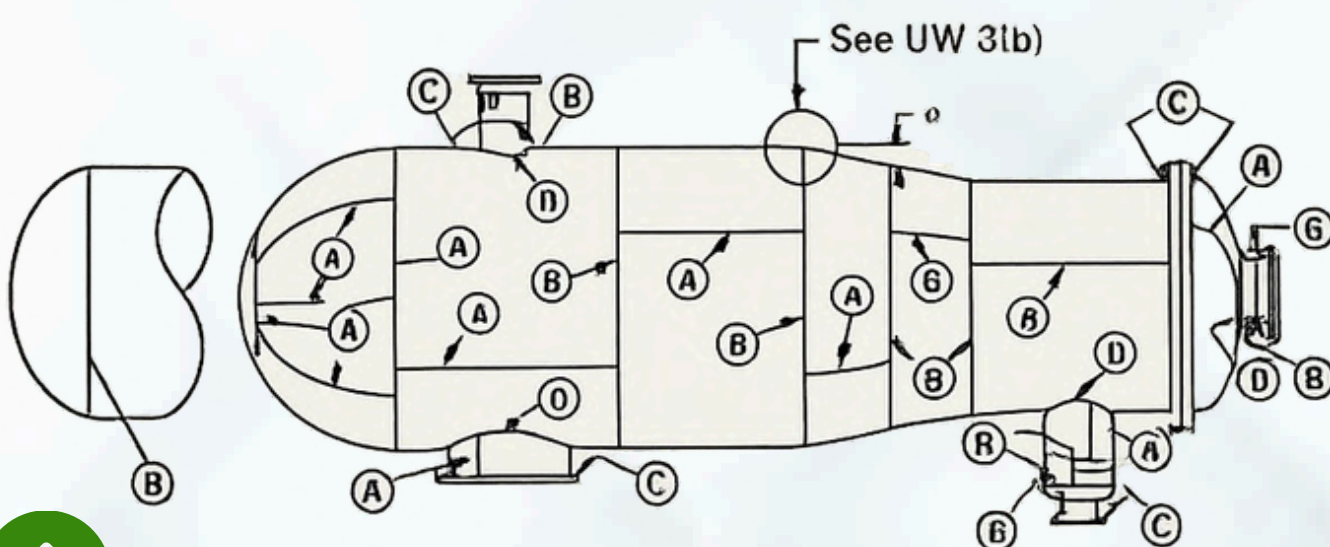


Figure UW-3
Illustration of Welded Joint Locations Typical of Categories A, B, C, and D



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Material Requirements (Part-3)

(5 hrs)

- 3.2.6 -Material Certification
- 3.3.3 -Ultrasonic Examination
- 3.3.5 -Magnetic Particle/Liquid Penetrant Examination
- 3.7 -Requirements for Bolting Materials
- 3.11 -Impact Test Requirements
- Requirement for Material Test Coupons for Vessels subject to Heat Treatment
 - 1)Effect of alloying elements on material properties
 - 2) Material product forms
 - 3)Material specifications
 - 4)Material selection guide

Design Temperature, °F	Material	Plate	Pipe	Forgings	Fittings	Welding
Cryogenic	Austenitic steel	SA-240/SA-240M, SA-242, SA-242M, SA-243, SA-243M	SA-240/SA-240M, SA-242, SA-242M, SA-243, SA-243M	SA-240/SA-240M, SA-242, SA-242M, SA-243, SA-243M	SA-240/SA-240M, SA-242, SA-242M, SA-243, SA-243M	SA-240/SA-240M with SA-194.4
		SA-240	SA-240M	SA-240	SA-240/SA-240M	
Low Temperature	SA-516	SA-516-60	SA-516-60	SA-516-60	SA-516-60/SA-516-60M	SA-516-60 with SA-194.4
		SA-516-70	SA-516-70	SA-516-70	SA-516-70/SA-516-70M	
	Carbon steel	SA-516-60, SA-516-70, SA-516	SA-516-60	SA-516-60/SA-516-70	SA-516-60/SA-516-70	SA-516-60 with SA-194.4
		SA-516-60, SA-516-70, SA-516	SA-516-60, SA-516-70, SA-516	SA-516-60/SA-516-70	SA-516-60/SA-516-70	
		SA-516-60, SA-516-70, SA-516	SA-516-60, SA-516-70, SA-516	SA-516-60/SA-516-70	SA-516-60/SA-516-70	
Intermediate Temperature	SA-516	SA-516-60, SA-516-70, SA-516	SA-516-60	SA-516-60/SA-516-70	SA-516-60/SA-516-70	SA-516-60 with SA-194.4
		SA-516-60, SA-516-70, SA-516	SA-516-60	SA-516-60/SA-516-70	SA-516-60/SA-516-70	
	SA-516	SA-516-60, SA-516-70, SA-516	SA-516-60	SA-516-60/SA-516-70	SA-516-60/SA-516-70	SA-516-60 with SA-194.4
		SA-516-60, SA-516-70, SA-516	SA-516-60	SA-516-60/SA-516-70	SA-516-60/SA-516-70	
		SA-516-60, SA-516-70, SA-516	SA-516-60	SA-516-60/SA-516-70	SA-516-60/SA-516-70	
Elevated Temperature	SA-516	SA-516-60, SA-516-70, SA-516	SA-516-60	SA-516-60/SA-516-70	SA-516-60/SA-516-70	SA-516-60 with SA-194.4
		SA-516-60, SA-516-70, SA-516	SA-516-60	SA-516-60/SA-516-70	SA-516-60/SA-516-70	
	SA-516	SA-516-60, SA-516-70, SA-516	SA-516-60	SA-516-60/SA-516-70	SA-516-60/SA-516-70	SA-516-60 with SA-194.4
		SA-516-60, SA-516-70, SA-516	SA-516-60	SA-516-60/SA-516-70	SA-516-60/SA-516-70	
		SA-516-60, SA-516-70, SA-516	SA-516-60	SA-516-60/SA-516-70	SA-516-60/SA-516-70	

The Effect Of Alloying Elements On The Properties Of Steel							
Alloying Elements	Mechanical Properties				Carbide formation	Machinability	Corrosion Resistance
	Hardness	Strength	Toughness	High temp Stability			
Silicon	+	+	+	+	+	+	+
Manganese in Pearlitic Steel	+	+	+	+	+	+	+
Manganese in Austenitic Steel	+	+	+	+	+	+	+
Chromium	+	+	+	+	+	+	+
Nickel in Pearlitic Steels	+	+	+	+	+	+	+
Nickel in Austenitic Steels	+	+	+	+	+	+	+
Aluminum	+	+	+	+	+	+	+
Tungsten	+	+	+	+	+	+	+
Vanadium	+	+	+	+	+	+	+
Cobalt	+	+	+	+	+	+	+
Molybdenum	+	+	+	+	+	+	+
Copper	+	+	+	+	+	+	+
Sulphur	+	+	+	+	+	+	+
Phosphorus	+	+	+	+	+	+	+



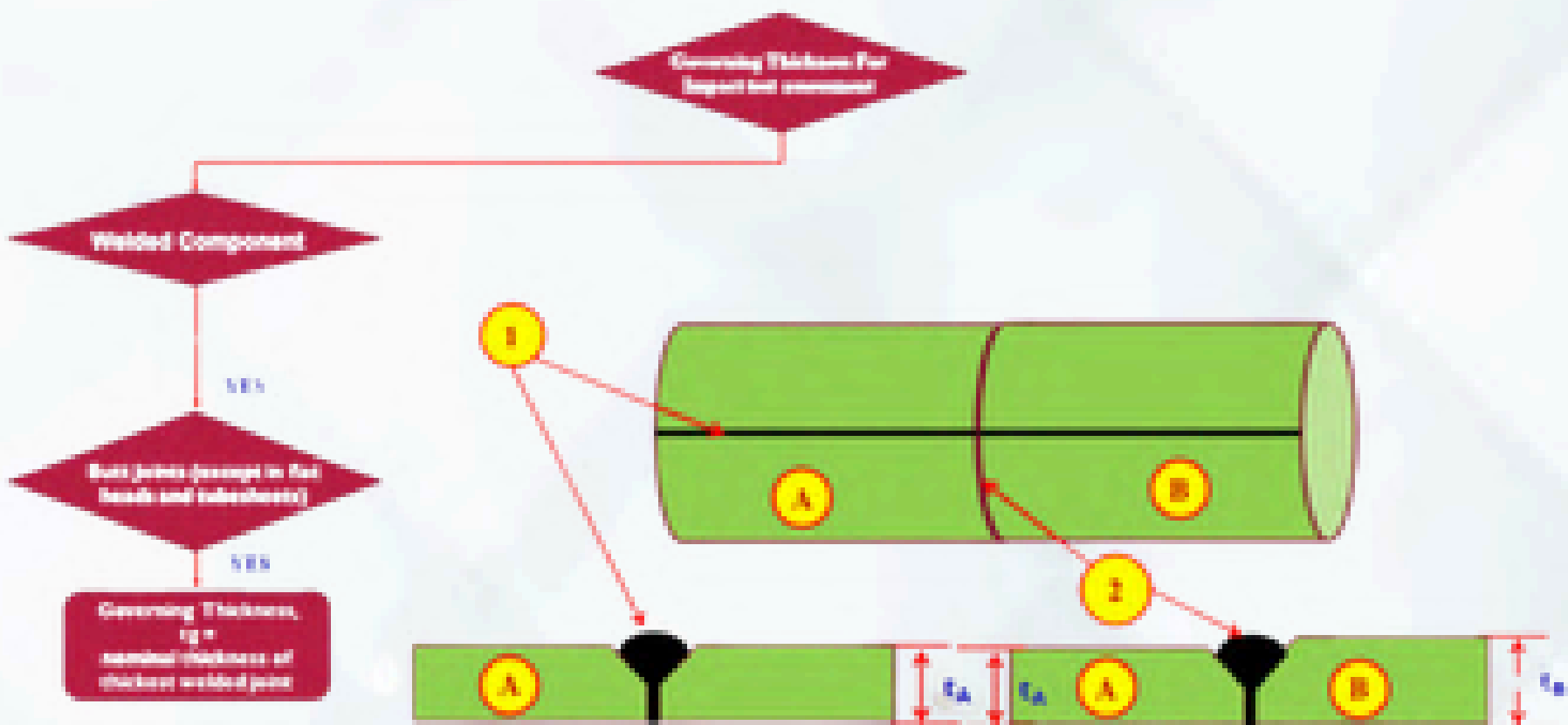
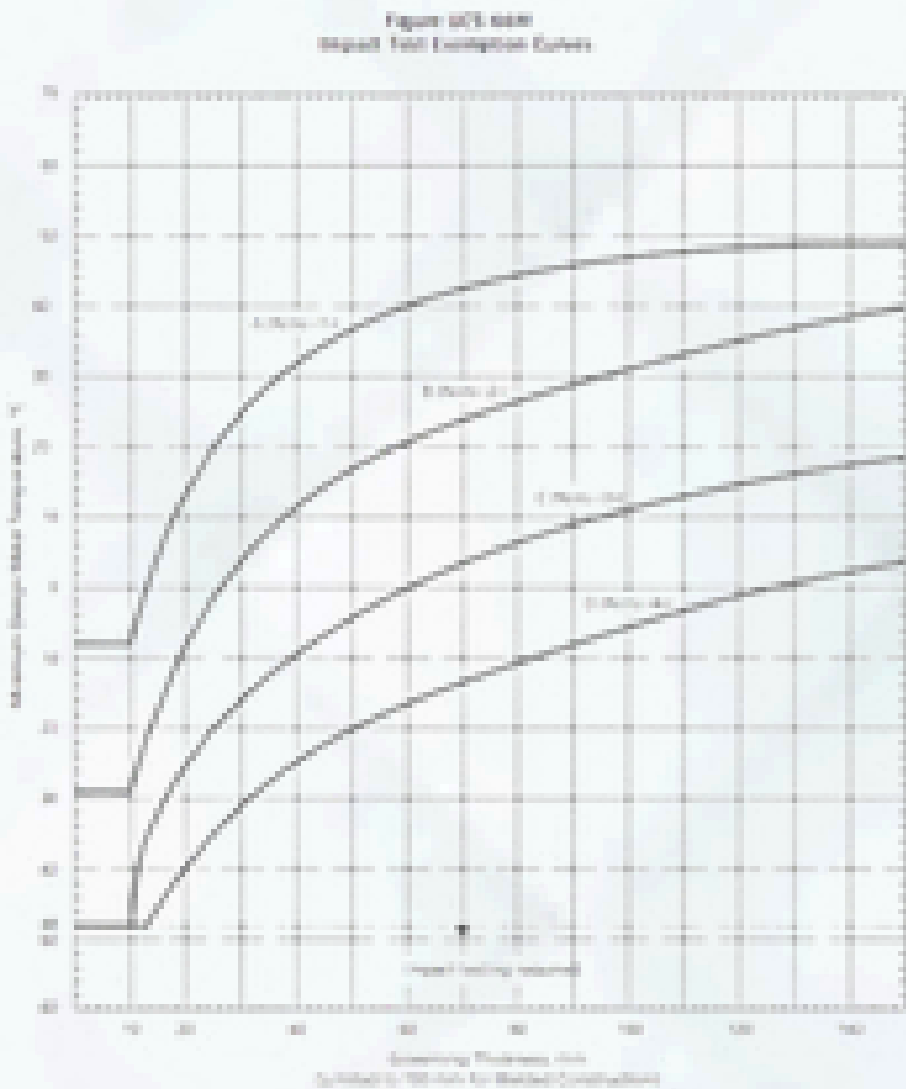
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- Low temperature working of different material.
- Governing thickness concept for impact testing.
- Understanding Impact test requirement.
- Impact test code exemptions.
- Impact test acceptance criteria.
- Material Thickness criteria for impact test.
- Impact test exemption curves.
- Manual Problem solving for Impact
- Testing requirement.



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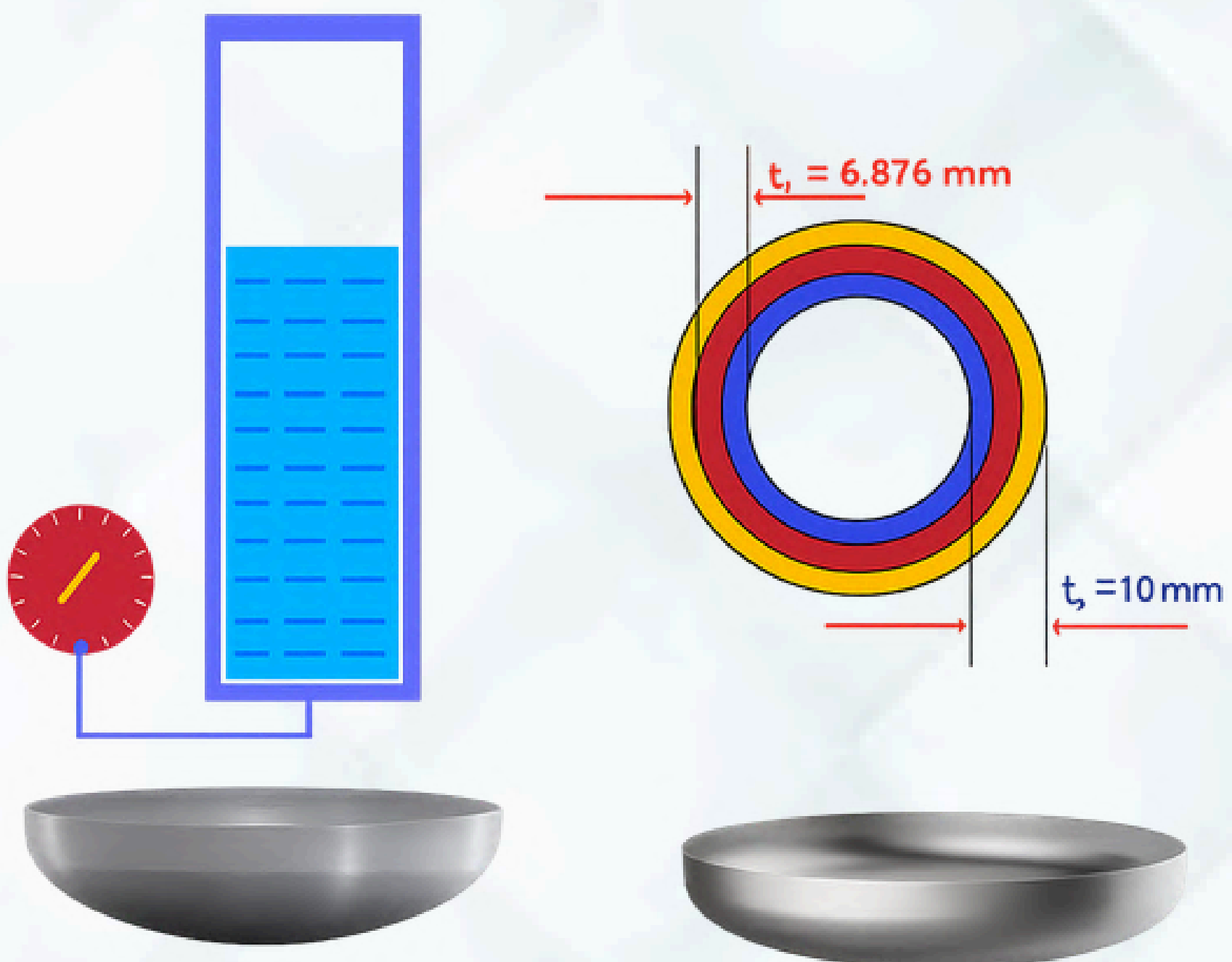
Pressure Vessel Design (DIV 2)

4

Internal Pressure Calculations

(7 hrs)

- Requirements for Class 1 vs Class 2 Design Methodology
- 4.1.5.3- Loads & Load Combinations
- Table 4.2.4 - Various acceptable Weld Joint Designs
- 4.2.1 - Requirements of various weld categories (A,B,C,D,E,F)
- 4.1.3.2 - Mill Tolerance on Plates & Pipes
- Tolerances on Shell & Dished End for Internal Pressure
- Important Definitions & Nomenclature
- Concept of MAWP
- Liquid Static head calculations
- 1.4 - Units & Conversion
- Thickness calculation for internal pressure for
 - Cylindrical shell - 4.3.3
 - Spherical & Hemispherical shell - 4.3.5
 - Conical shell - 4.3.4
 - Torispherical dished end - 4.3.6
 - Ellipsoidal dished end - 4.3.7
 - Flat Head Thickness calculations - 4.6



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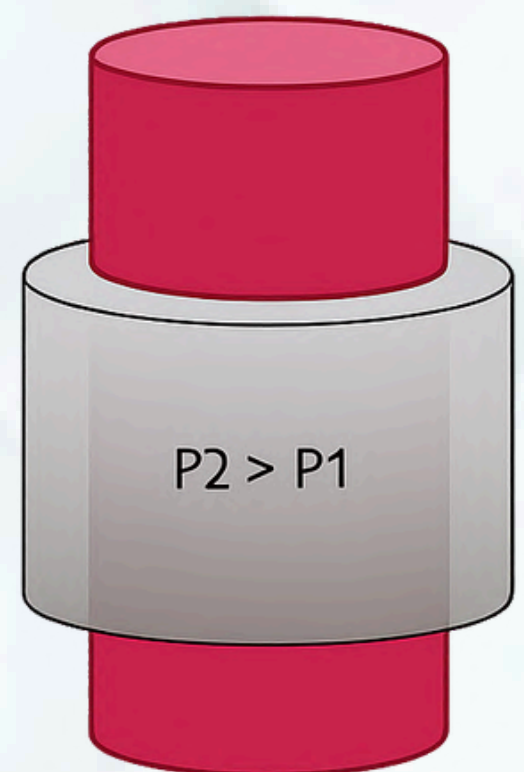
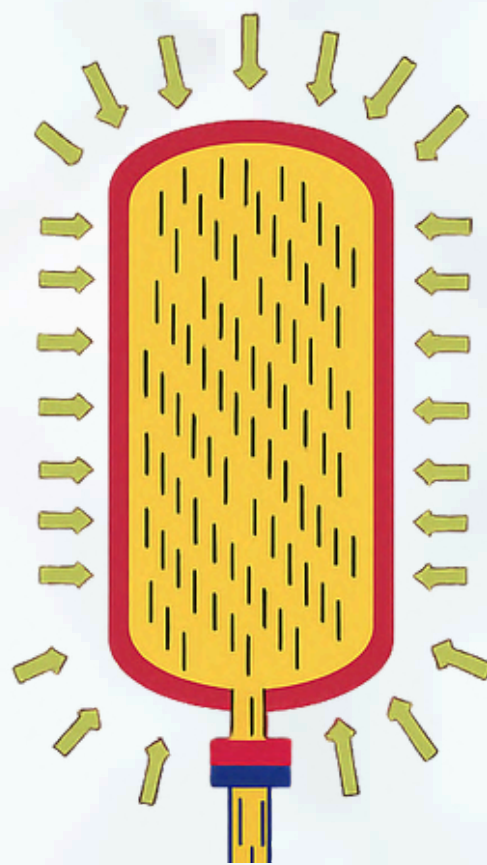
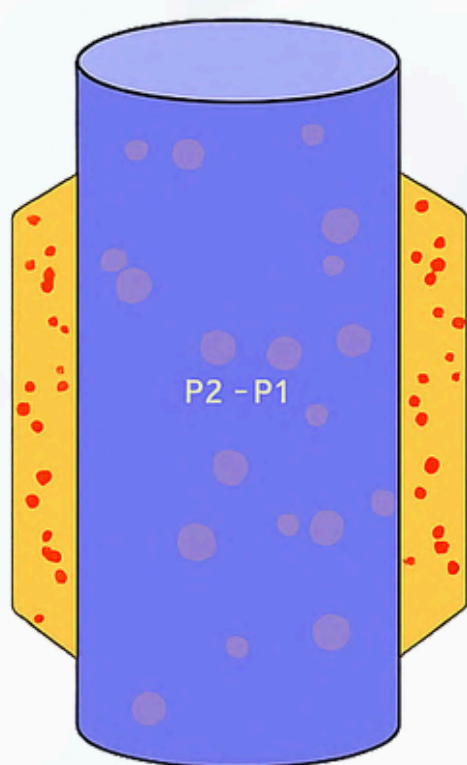
5

External Pressure Calculations

(7 hrs)

PRESSURE VESSEL DESIGN (DIV 2)

- Failures caused by External Pressure & Concept of External Pressure
- How external pressure works.
- Difference in Methodology for Div.1 vs Div.2
- Figure 4.4.2 - Line of support concept
- Thickness calculation for External pressure
 - 1) Cylindrical shell, Thickness reduction by using stiffeners - 4.4.5
 - 2) Spherical & Hemispherical shell - 4.4.7
 - Conical shell - 4.4.6
 - 3) Torispherical dished end - 4.4.8
 - 4) Ellipsoidal dished end - 4.4.9
 - 5) Concept of Stiffener design for external pressure
 - 6) Procedure for Stiffener design for external pressure - 4.4.5.2
 - 7) Moment of inertia calculations for various stiffener cross sections - 4.4.5.2
 - 8) Manual calculations of stiffener sizing



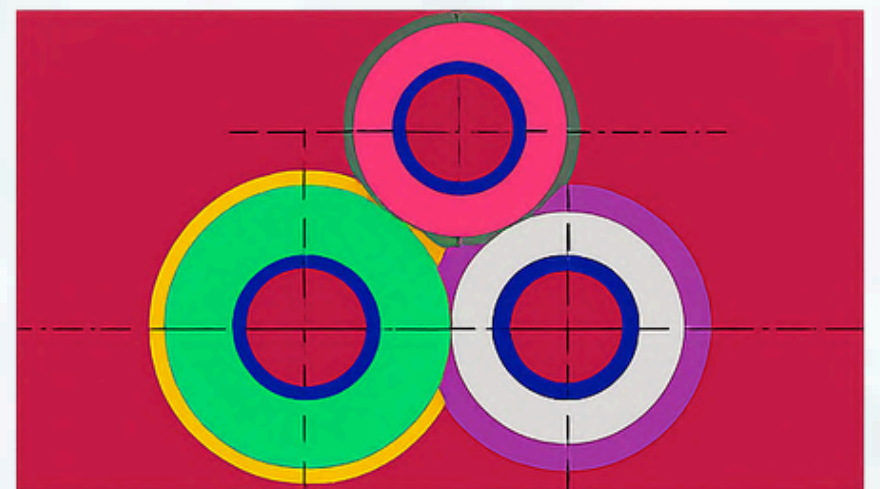
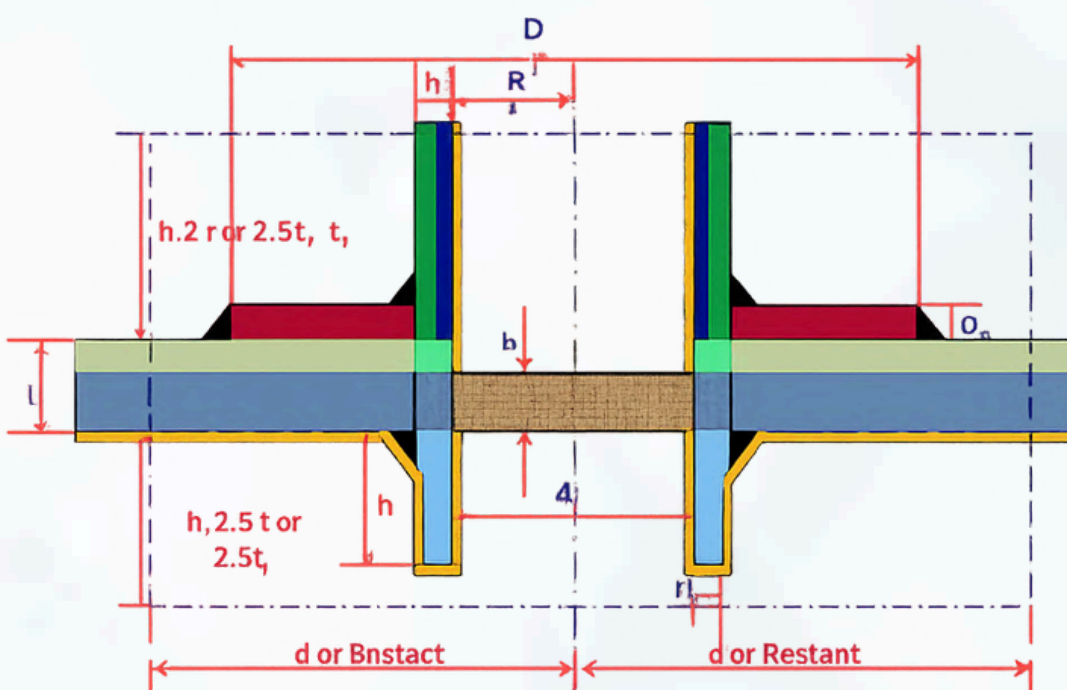
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- Types of nozzles 12 hrs
- Nozzle neck thickness calculation criteria - 4.5.4
- Nozzle neck thickness calculation as per para 4.3 & 4.4
- Methods of Nozzle Attachment
- Design of openings in **Cylindrical shells**:
 - 1) Radial Nozzle in Cylindrical Shell - 4.5.5
 - 2) Hillside Nozzle (Offset) in Cylindrical Shell - 4.5.6
- Design of openings in **Conical shells**:
 - 1) Radial Nozzle in Conical Shell - 4.5.8
 - 2) Parallel/Perpendicular Nozzle to longitudinal axis in Conical Shell - 4.5.9
- Design of openings in **Formed Heads**:
 - 1) Radial Nozzle in Formed Heads - 4.5.10
 - 2) Hillside Nozzle (Offset) in Formed Heads - 4.5.11
- Design of openings in **Flat heads** as per para 4.5.12
- Concept of Multiple openings criteria for Vessels - 4.5.13
- Manual Problem solving for Set in Nozzle
- Manual Problem solving for Set on Nozzle
- Manual Problem solving for multiple openings
- Manual Problem solving for openings in flat head pressure vessel
- Design of openings subject to axial compression, external pressure or combination



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Pressure Vessel Design (DIV 2)

7

Flange Design

(12 hrs)

- Types of Flanges as per its application.
- Selection Of Standard Flanges
- Scope Of Para 4.16
- Type of flanges as per Para 4.16
- Flange design concept & steps as per Para 4.16
- Defining Flange Geometry for Integral flange
- Defining Flange Geometry for Loose ring & optional type.
- Blind Flange Design concept
- Checking of Standard Flanges for External Forces & Moments
- Manual Problem for Integral Flange
- Manual Problem for Loose ring Flange
- Blind Flange Design calculations & fininding deflection as per TEMA
- Rectangulare Flange Design as per PD-5500



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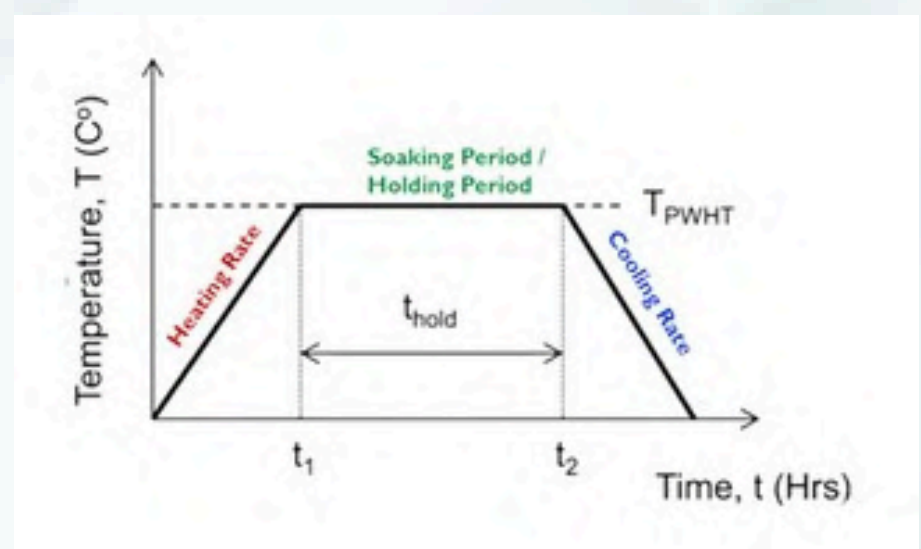
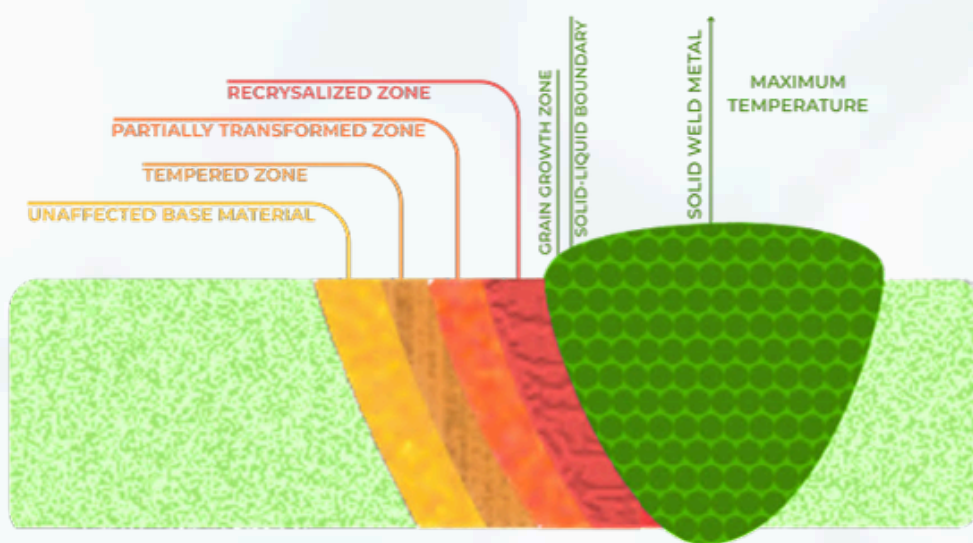
Pressure Vessel Design (DIV 2)

8

PWHT & PHFT

(5 hrs)

- HAZ and Residual stress understanding
- How stress relieving works?
- Understanding the need & significance of PWHT (Para 6.4)
- PWHT exemption requirements in ASME codes
- Procedures and methods for PWHT
- PFHT requirements of code
- Procedures for PFHT
- Heating / cooling rates
- Manual problems solving for PWHT & PFHT calculations

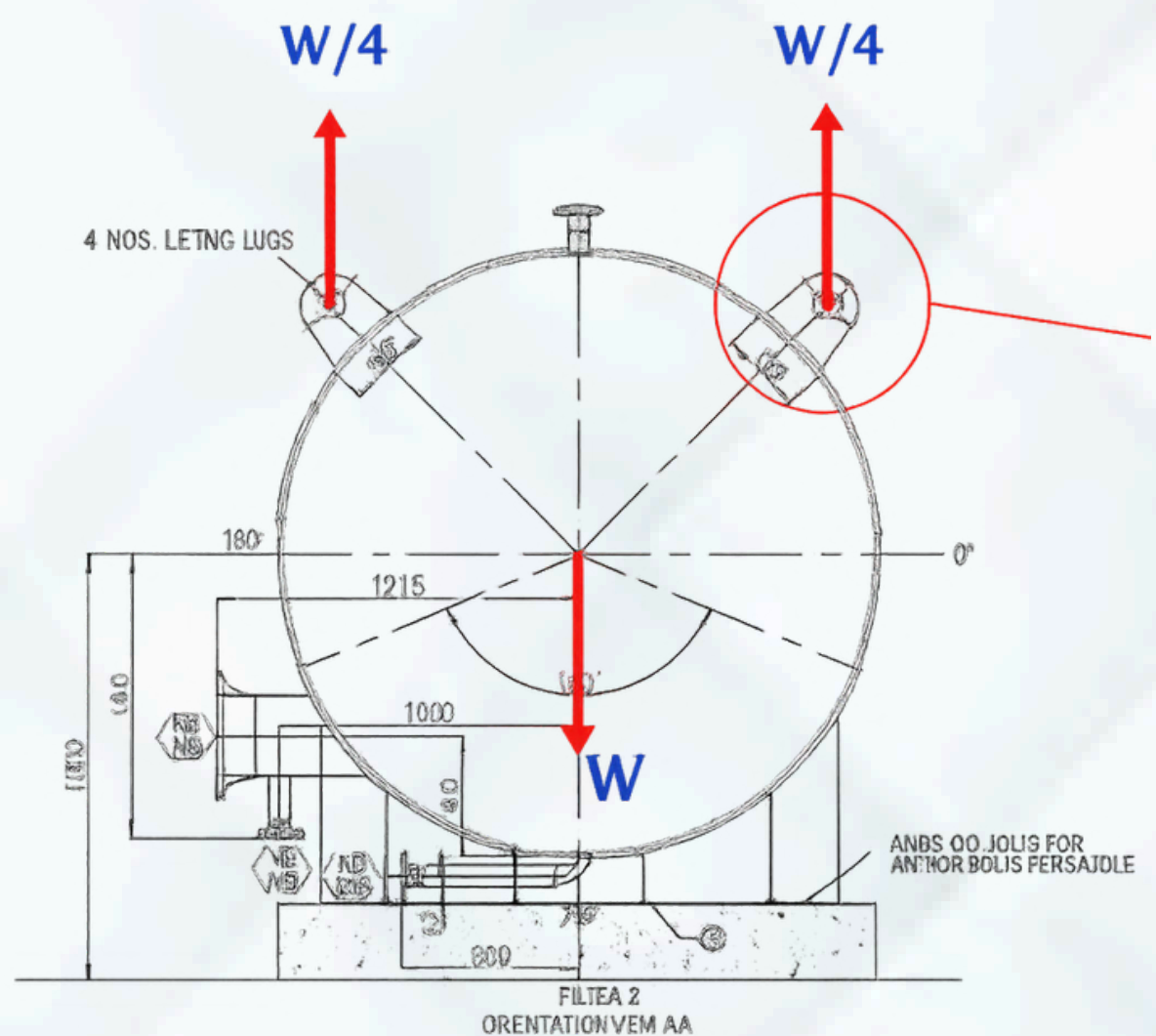


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Lifting Lug design

(2 hrs)

- Lifting Lug Design
- Lifting Lug Design-PV Elite



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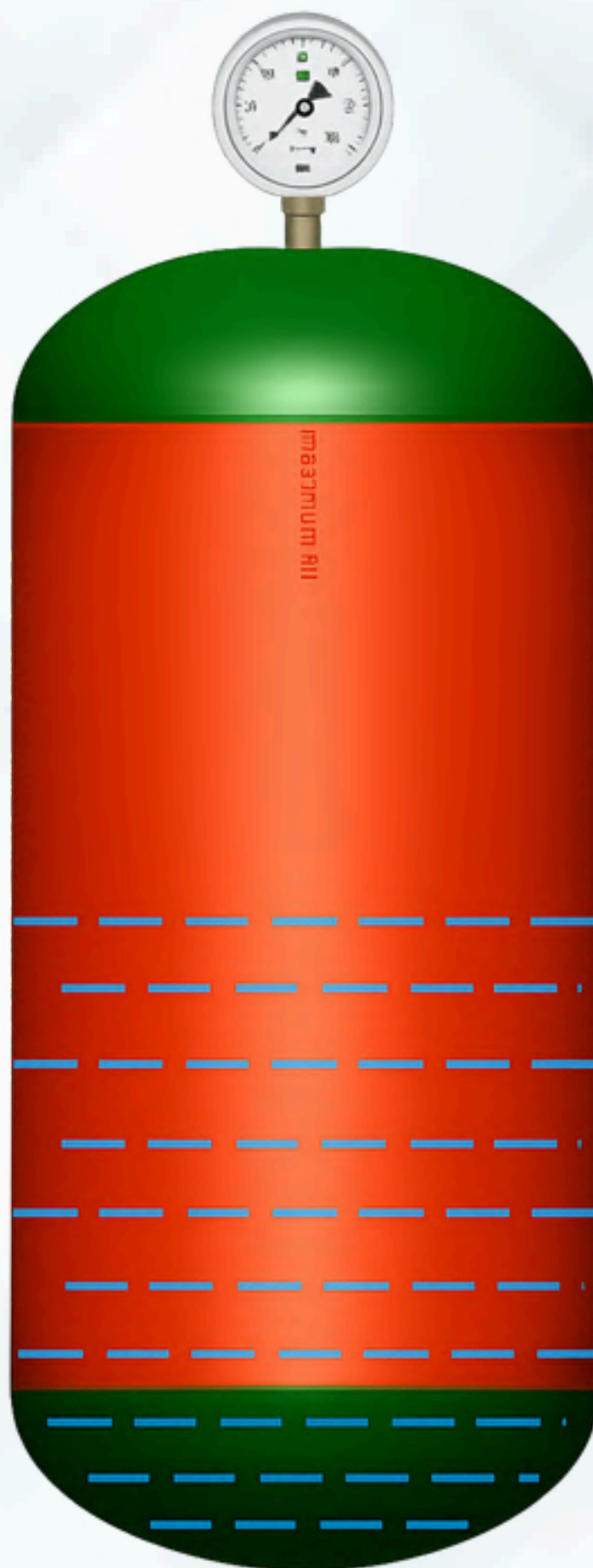
Pressure Vessel Design (DIV 2)

10

Hydrostatic Test, Pneumatic Test Requirements Of Code

(4 hrs)

- Pressure Testing requirements.
- Important definitions- MAWP, LSR, Calculated Test pressure.
- Hydrostatic Test requirement and significance.
- Hydrostatic Test procedure & Code requirements.
- Pneumatic Test requirement and significance.
- Pneumatic Test procedure and Code requirements.
- Calculating Test pressures, inspection pressures.
- Understanding pressurization stages, Test temperatures, & Test time significance.
- Proof Tests to establish maximum allowable working pressure.
- Manual Problem solving & PV Elite hydrotest calculations.



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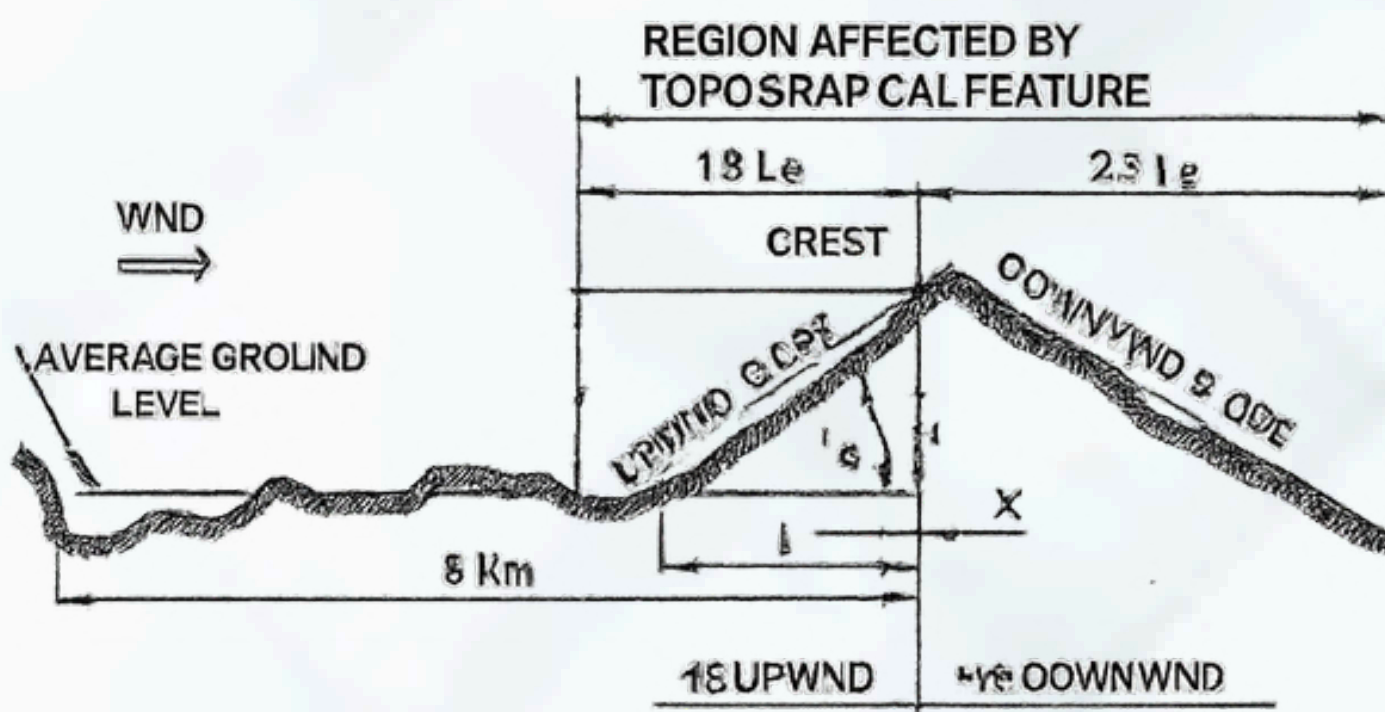
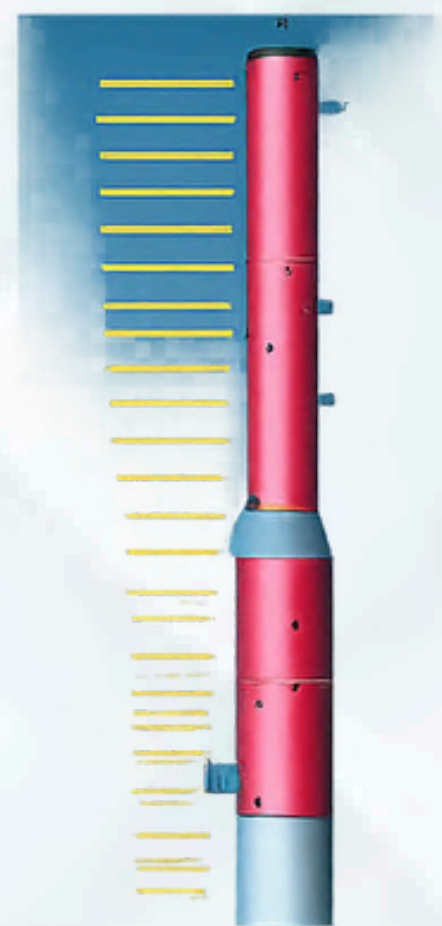
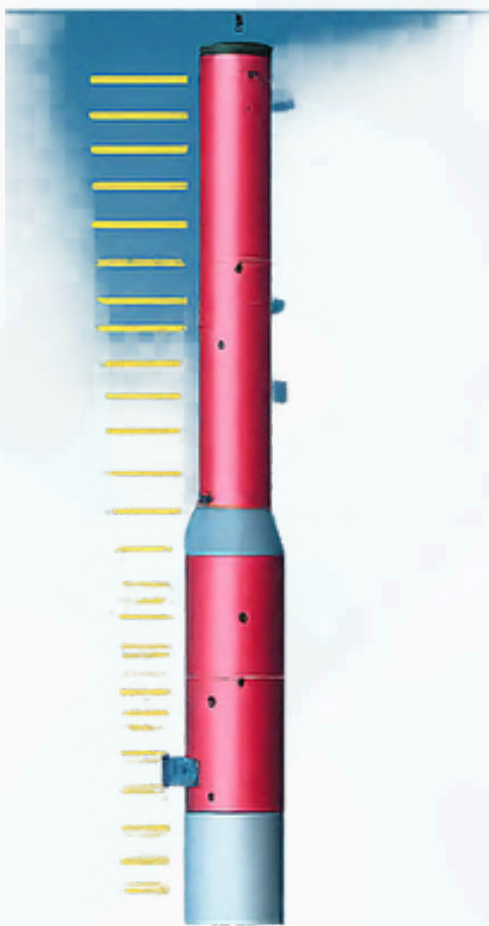
Pressure Vessel Design (DIV 2)

11

Wind , Seismic & Combine Loading

(9 hrs)

- Understanding Concept of Wind load
- Calculation of wind load as per IS 875
- Understanding concept Of Seismic load
- Calculation of seismic load as per IS 1893
- Concept of Combine Loading
- Manual Problem Solving for seismic Load + Pv Elite calculations
- Manual Problem Solving for wind Load + Pv Elite calculations
- Manual Problem Solving for combine loadings + Pv Elite calculations



13 (4) GENERAL NOTATIONS



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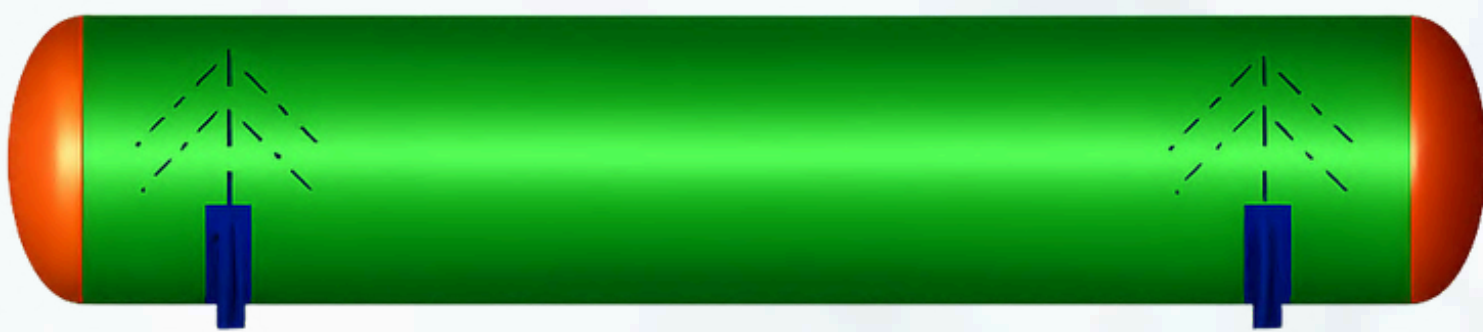
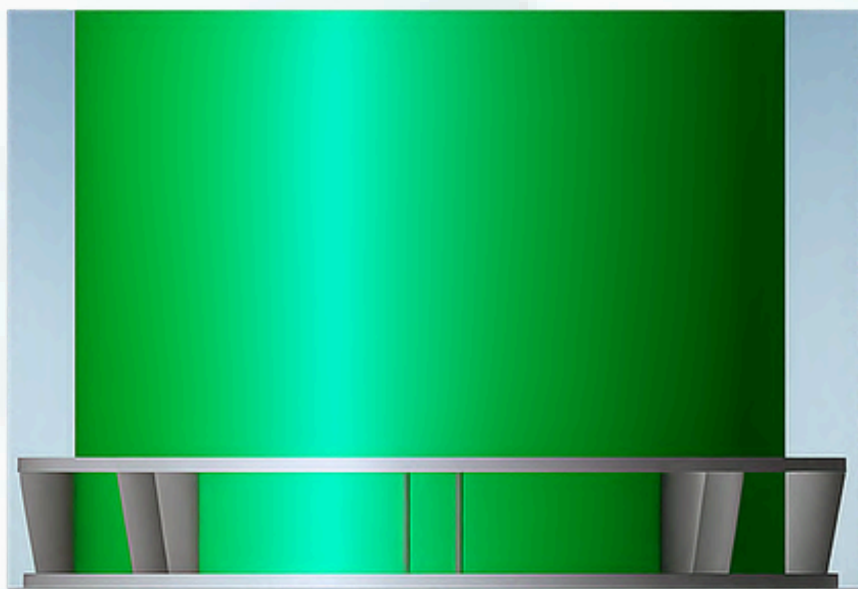
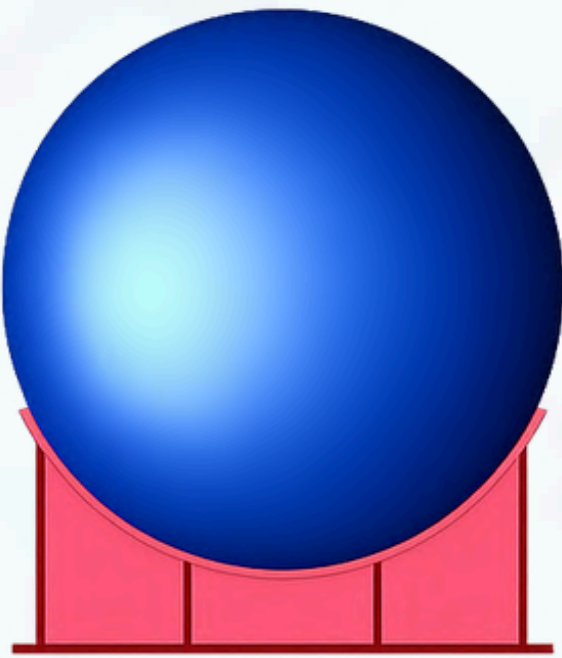
Pressure Vessel Design (DIV 2)

12

Supports

(6 hrs)

- Types of Supports.
Significance of following types of supports
 - Skirt Support
 - Leg Support
 - Lug Support
 - Saddle Support
- Stresses in Vessel due to Saddle Locations.
- Procedure for saddle support location.
- Calculation of stresses in vessel component - 4.15.3
- Manual Problem Solving for calculation of stresses in vessel
- Manual Problem Solving for saddle support design
- WRC concept and sign conventions



13

Fatigue Evaluation

(2 hrs)

- Concept of Fatigue
- Fatigue Evaluation as per para 5.5.2.2



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About Us



Why Choose Us

With vast domain experience, highly capable & equipped Engineering Team we are specialized in providing the most professional Engineering services with fast turn around time. We also help businesses meet their goals with our cutting edge Engineering & Training services.



Mission

Our mission is to deliver world-class engineering solutions with simplicity, precision, and speed, while empowering professionals through comprehensive training that meets global industry standards.



Vision

To create a future where our cutting-edge expertise in engineering solutions and professional training empowers both clients and the industry, making us an indispensable partner in their success.



Our Core Values

1) INNOVATION

We consistently challenge the status quo by exploring new ideas & technologies to deliver creative, cutting-edge solutions.

2) INTEGRITY

We operate with unwavering honesty & transparency, building lasting trust with every client and partner.

3) CUSTOMER FOCUS

We are committed to understanding our clients' unique challenges & providing tailored, value-driven solutions.

4) ETHICS

We collaborate & support one another, believing our collective strength drives the best results for our clients.



Know The Trainer



Sachin Pol

Sachin is a Mechanical Engineer from Pune University and a Postgraduate in Pressure Vessel Design. He has **15+ years' experience in Static Equipment Design**. He has worked in the field of Process Industry, Renewable Energy, Oil & Gas and Power Sector.

He is a well-known **corporate trainer** with versatile experience in the field of Static Equipment Design and FEA. He has successfully conducted trainings on PV Elite and ASME Codes across the globe for **more than 3500 professionals**.

Sachin served in some esteemed organizations like PRAJ, Thermax, Quadrogen.

He was an official presenter for Flange Design, Lifting Lug Design & WRC sign conventions at **CAU 2018** organized by Image Graphix across 8 cities in India.

With thorough technical knowledge and unmatched problem solving ability he has supported the customers to address their challenges and deliver quality output.



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Who Should Do This Course?



How We Can Help..!



Mechanical Engineer aspiring to make a career in Static Equipment Design in the field of Oil & Gas, Process Industry, Refinery, EPC, Chemical, Pharma & Power Sector.



Static Equipment Design Engineers looking to develop and excel in their role. This training will help them to **better understand** the code requirements and to **optimize the Design**. They will be able to **understand & resolve the queries and comments from customers and authorized inspectors**. They can **get answers** to their questions related to **live projects** as well. **No more delay** in Design due to any technical queries or questions.



Any Engineer seeking to switch to Static Equipment Design. The **in-depth** course content with detailed explanation of **code requirements, manual calculations** and easy to understand training material make it convenient to **transform** themselves into a **highly proficient** Static Equipment Design Engineer **in few months**.



Proposal/ Estimation Engineer looking to enhance their knowledge about materials, Design & various code requirements. This will help them to **optimize Design in a very short time** to match the proposal submission schedule.



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Design Services

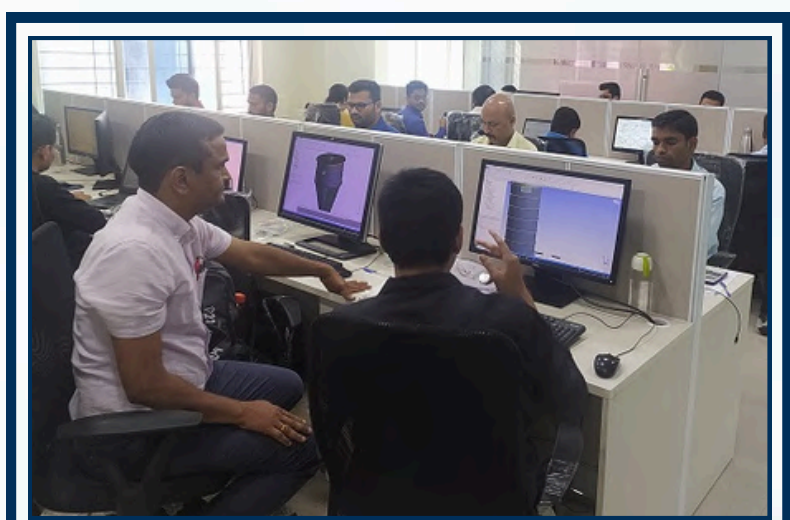
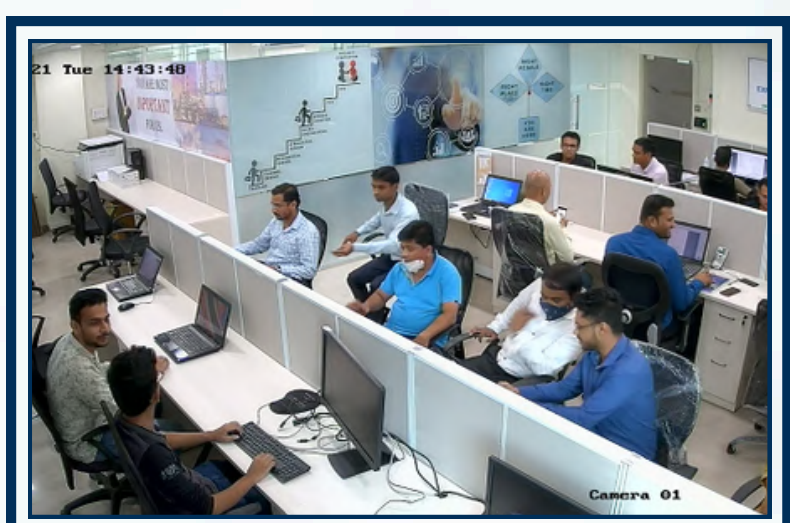
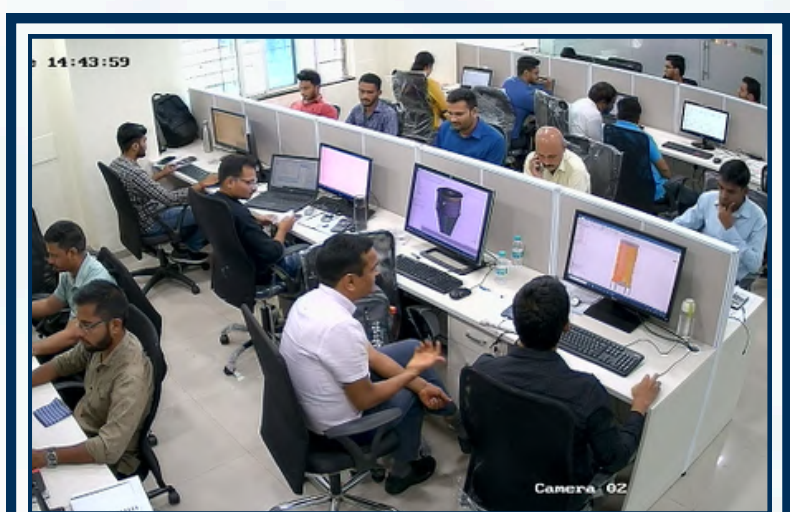


About Us

With vast experience in Static Equipment, Structure, Thermal & Piping Design, offer the best cost-efficient solutions to our customers. Our Engineering team is capable to deliver Design of Pressure Vessel, Heat Exchanger, Condenser, Reactor, Column, Storage Tank, and other static equipment, as per various national and international codes and standards.

The team is well experienced and trained to deliver Design as per ASME Sec VIII Div-1, Div-2, PED, AD Merk Blatter, PD5500, AS1210, GOST, TEMA, API 660, API 650, API 620, IBR, EN13445, etc.

We have successfully completed many ASME U-stamp audits and worked on hundreds of U-stamp vessels closely with many certifying agencies.



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Training Services



About Us

Our training program is the most professional and unique platform for Static Equipment Engineers. We are an Authorised Training Provider for ASME. We mean it, when we say, **“No one can de-code the code like us”**, as we have the experience and knowledge of working on various national and international codes and standards.

With a vast experience of Designing various Static Equipment, we provide the most **comprehensive** and **detailed** training courses to meet your needs. Within a short period, we have become the **most preferred training provider** to a lot of corporates and individuals.



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Corporate Training



Onsite Corporate Trainings

We have been instrumental in developing the workforce for organizations through our onsite training under our corporate training program. These training has helped the corporates to develop the skills and knowledge of their resources and as a result increase the output with better and optimized design of equipment.



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Our Customers



Our Corporate Customers

We have been instrumental in developing the workforce for organizations through our onsite training under our corporate training program. These training has helped the corporates to develop the skills & knowledge of their resources & as a result increase the output with better & optimized design of equipment.



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Our Track Record



How We Have Been Doing..!



100+

Corporate Customers



4000+

Satisfied Trained Individual
Online & Offline Combined



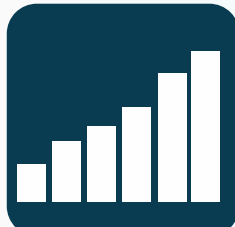
20+

Countries With Beneficiaries
Across The Globe

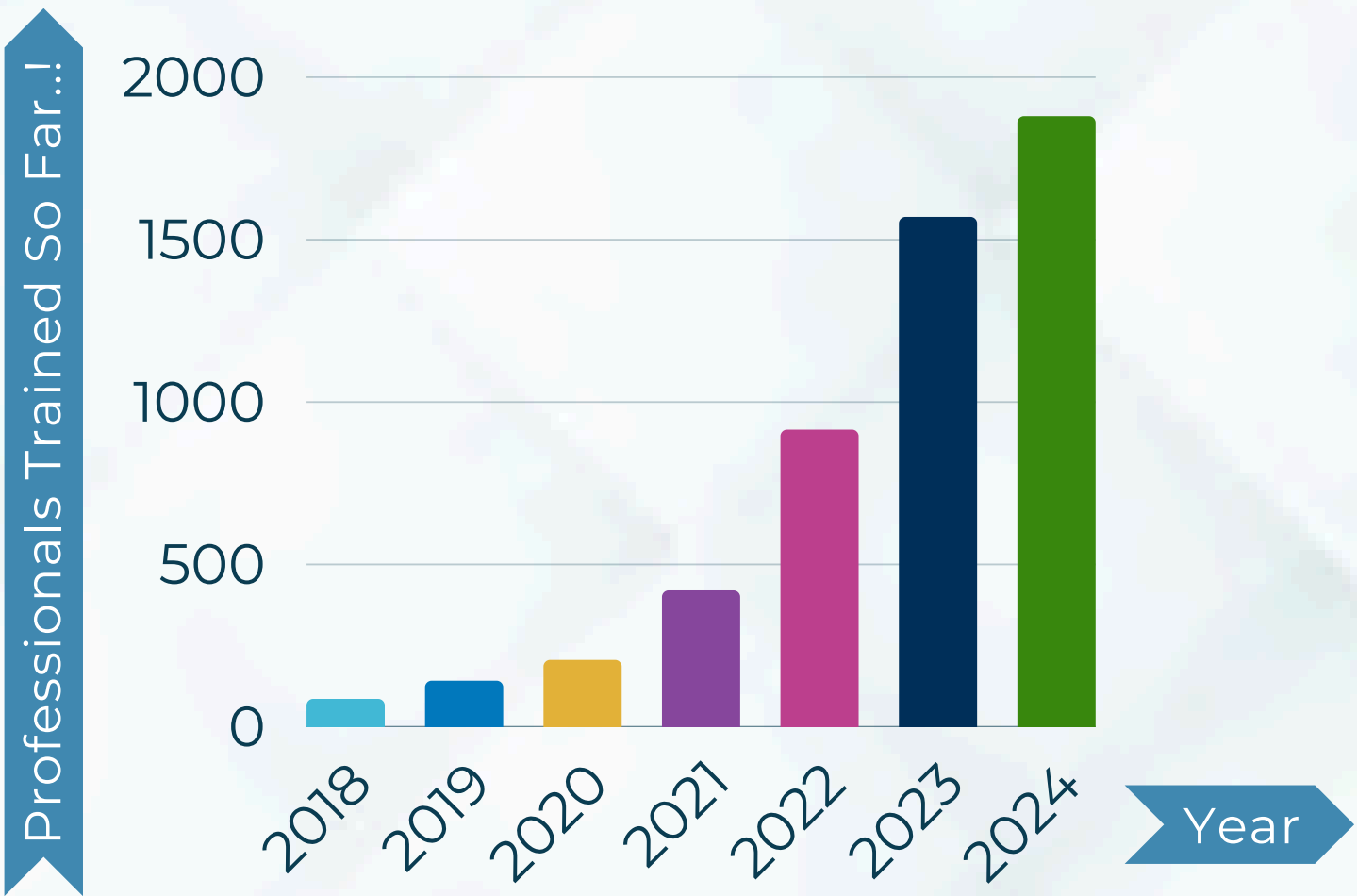


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Experience Range Of
Engineers Trained



Over The Year...!



Beneficiaries Across The Globe



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About Training Platform



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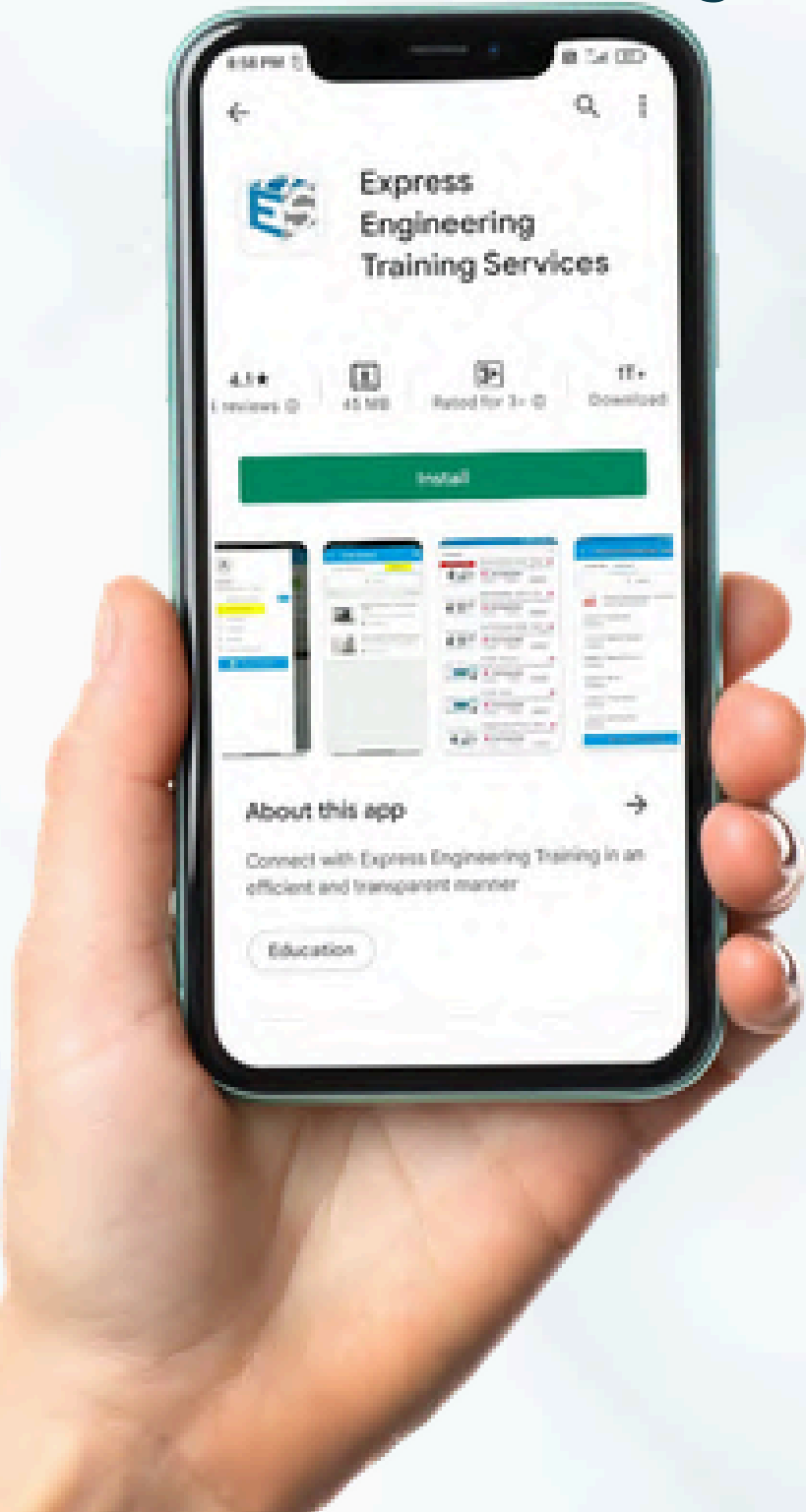


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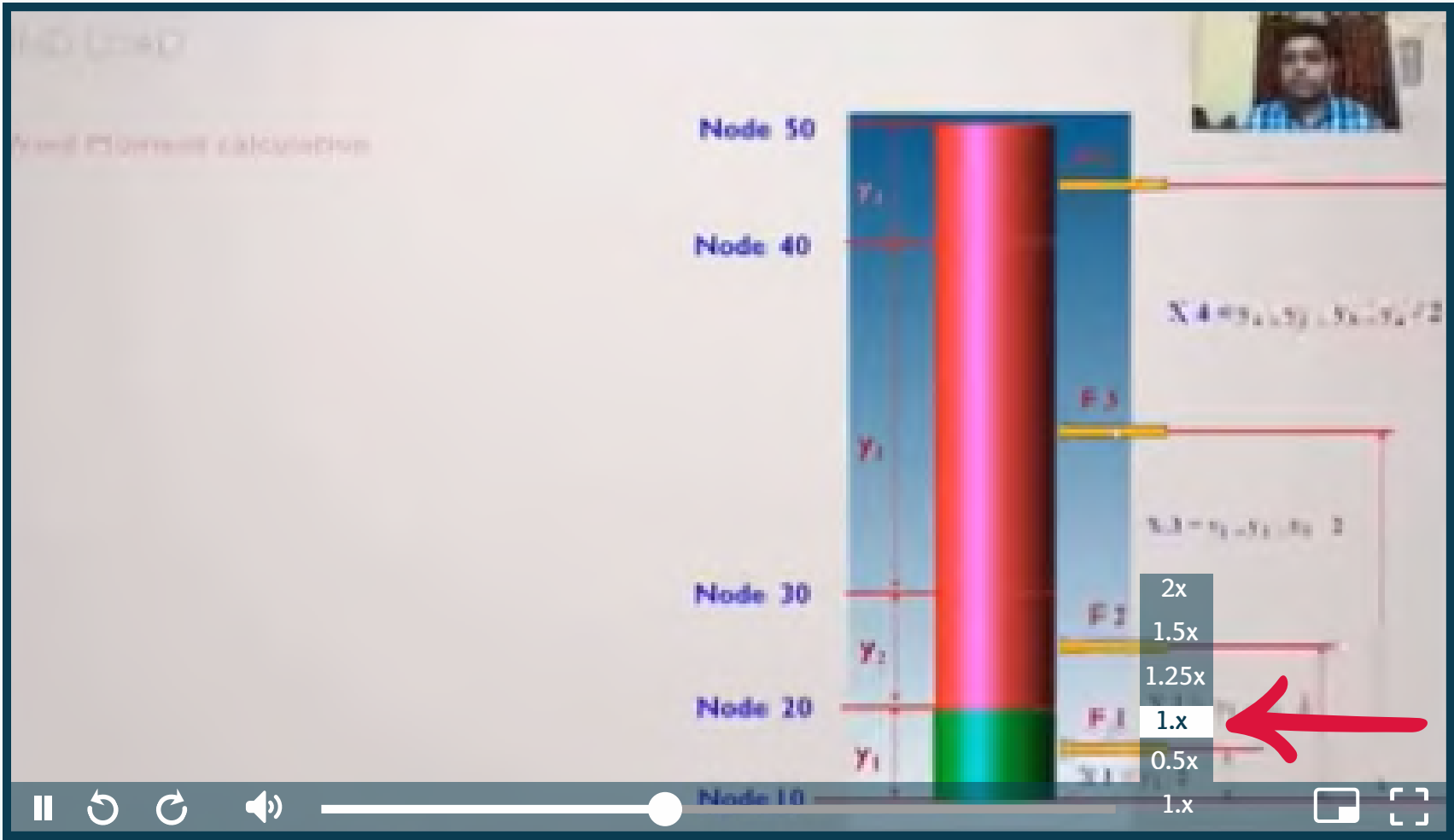


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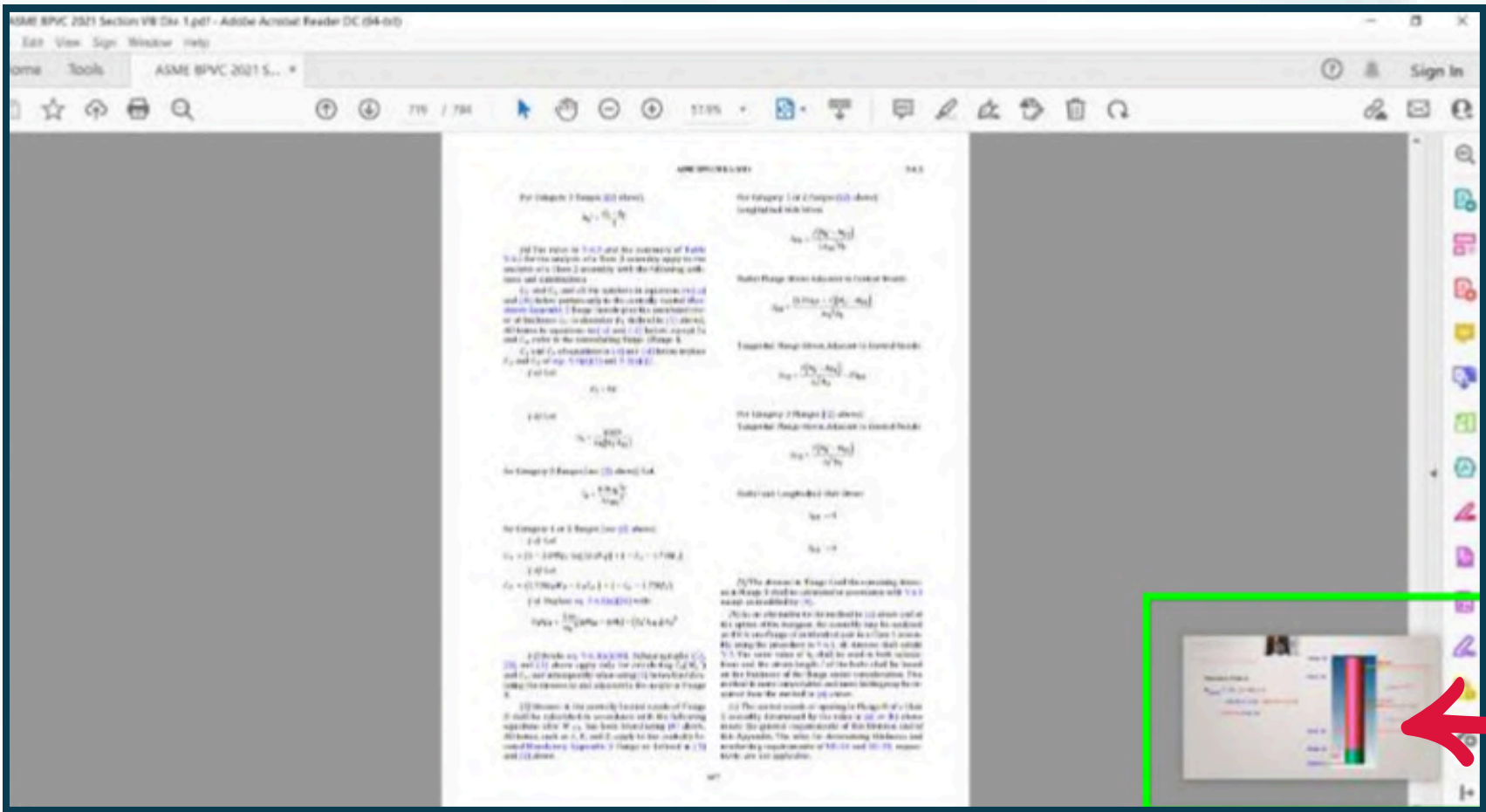


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PIP mode enables you to work or practice simultaneously while watching the lectures.



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Advantages Over Offline Courses



Benefits Of Online Training

Offline

Online

No more compromise on work or personal schedule

Getting late for the class. **Need to rush** or I'll miss the lecture.



I can **save travelling time** and **avoid stress** by watching lectures online **as per my convenience**.



Get answers on the go...!

I am stuck in the Project. But this topic is scheduled after 4 weeks in the live class. **How can I solve it now?**



I was stuck..! But I **just watched this topic online** and bingo..! **the problem is solved**. I simply love this platform.



Live Q&A session every week

The Classes are over. **Whom can I ask** the questions now?



My Course **validity is 18 months**. Also the **live Q&A session is twice a week**. I can get all the answers.



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Advantages Over Offline Courses



Benefits Of Online Training

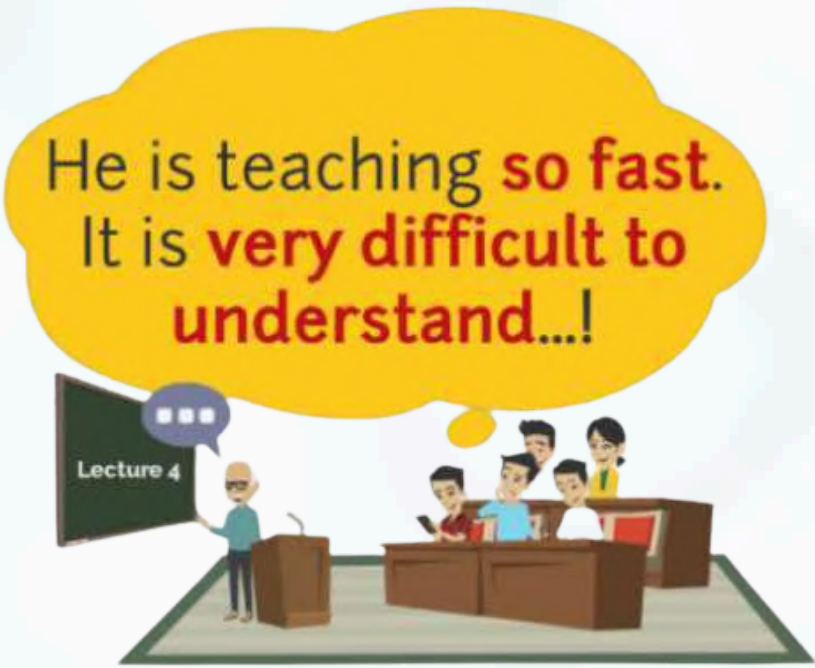
Offline

Online

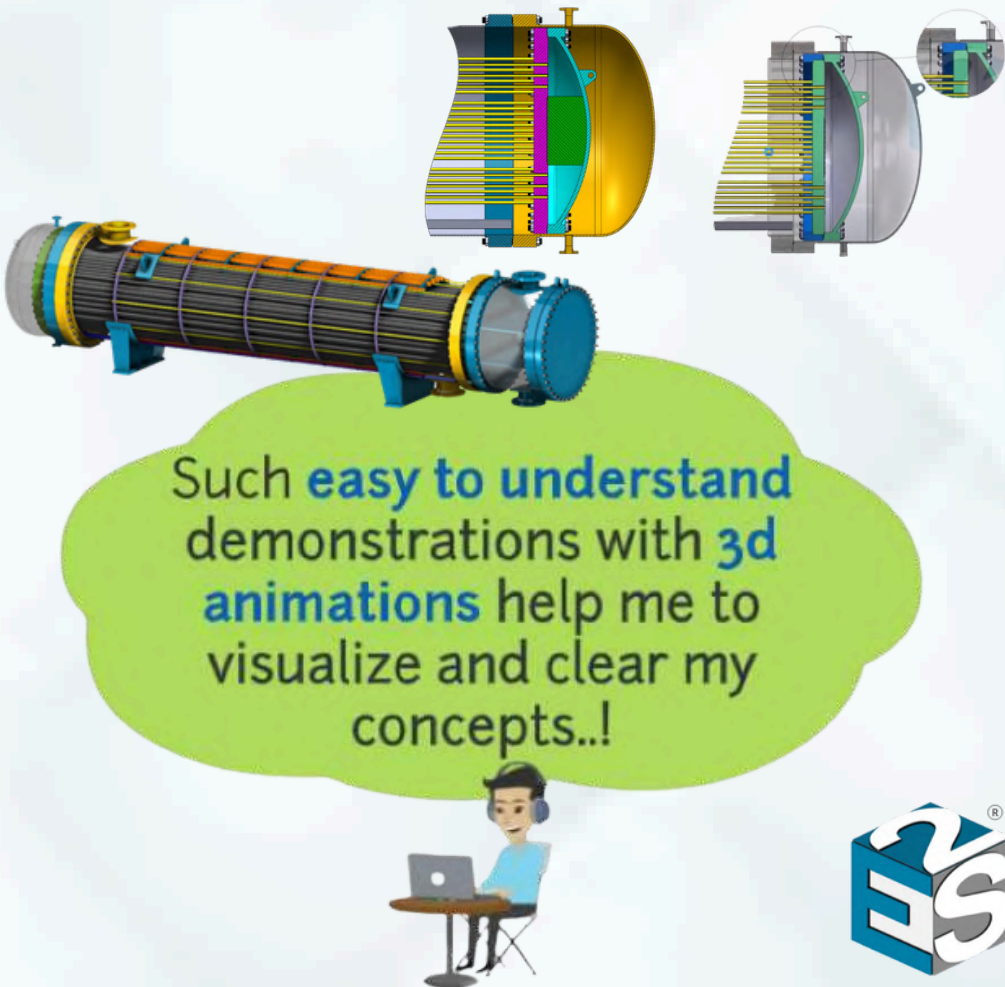
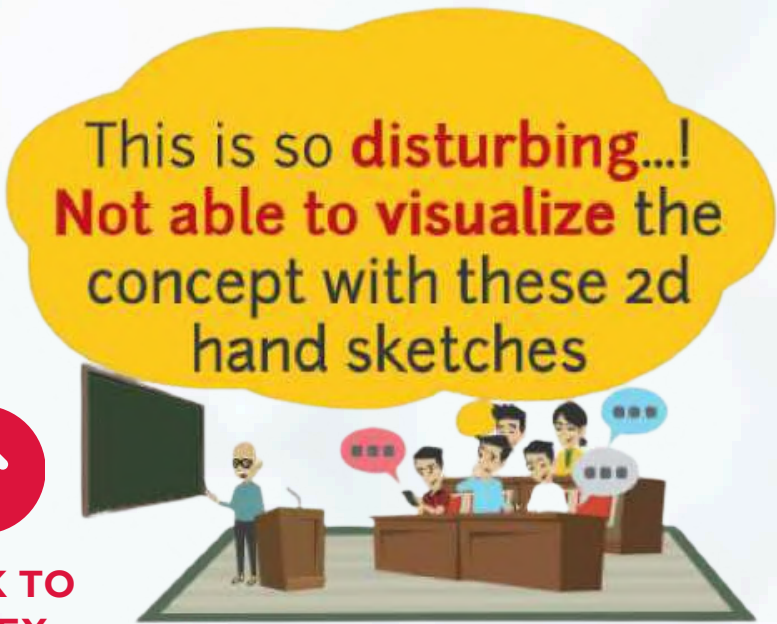
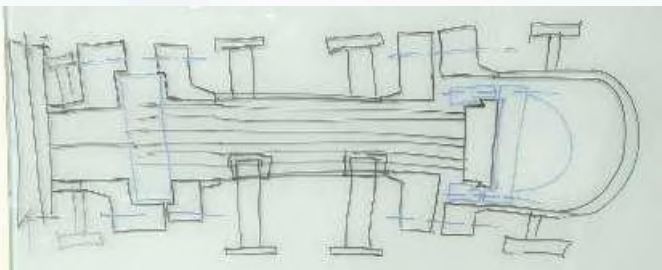
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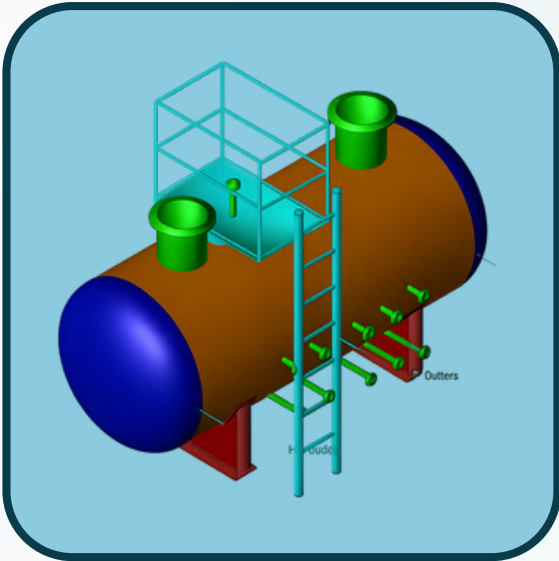
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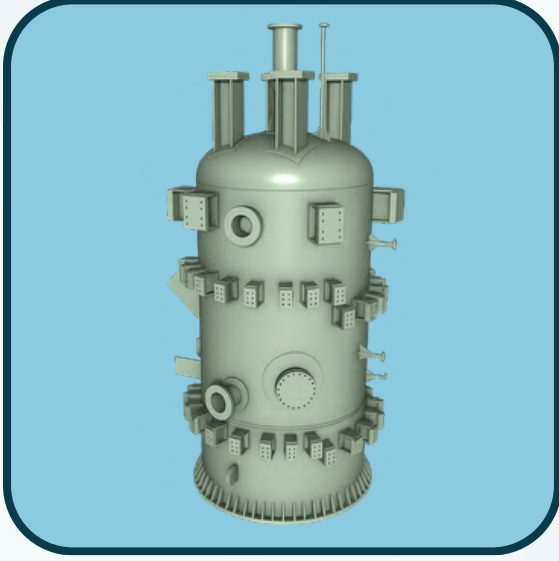
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STATIC EQUIPMENT DESIGN



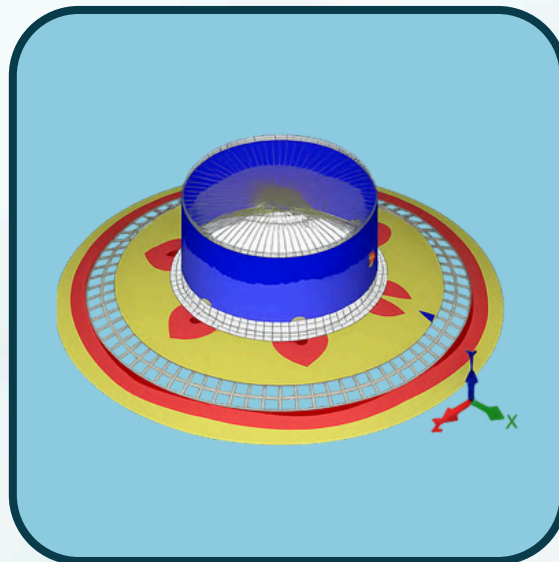
PRESSURE VESSEL
DESIGN (DIV 1)



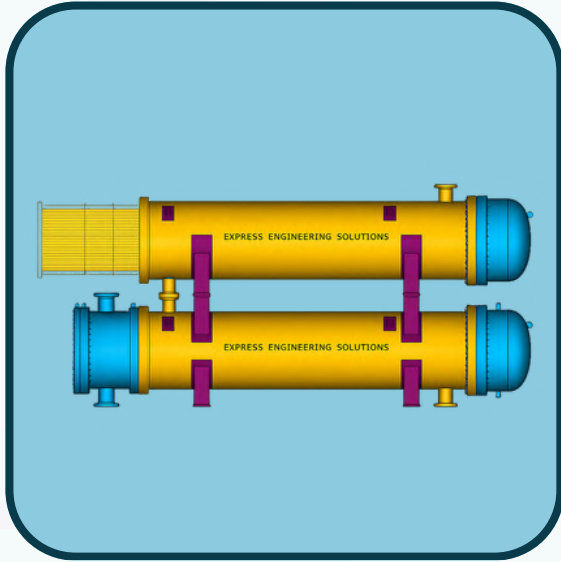
DIV 1 & DIV 2
COMBO



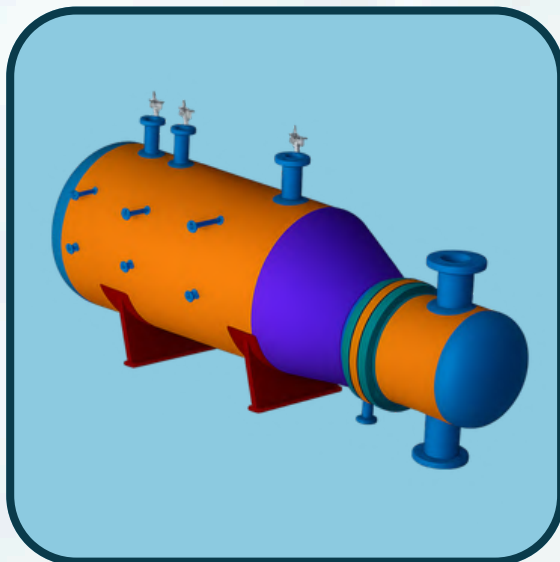
PREMIUM COMBO



NOZZLE PRO FEA



HEAT EXCHANGER
DESIGN



PV ELITE
SOFTWARE



ASME PD442



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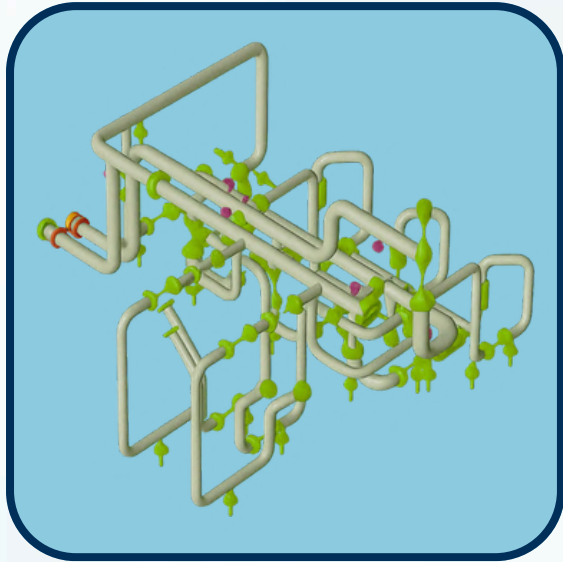
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PIPE STRESS ANALYSIS



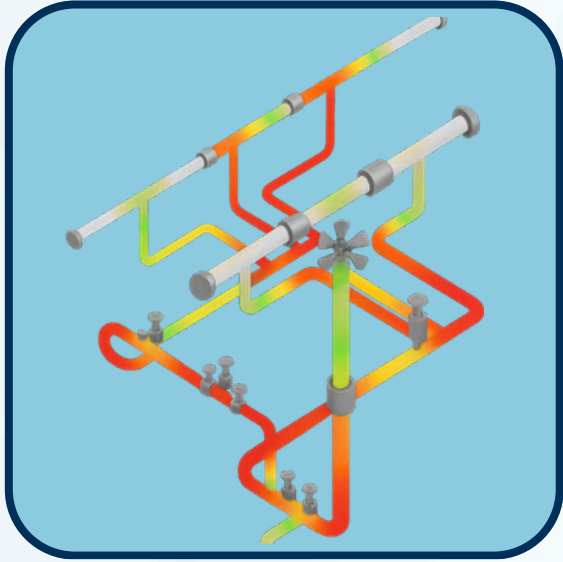
**BASIC PIPE
STRESS
ANALYSIS** 



**ADVANCE PIPE
STRESS
ANALYSIS** 



**BURIED
PIPELINE STRESS
ANALYSIS** 



**COMBO PIPING &
PIPELINE STRESS
ANALYSIS** 



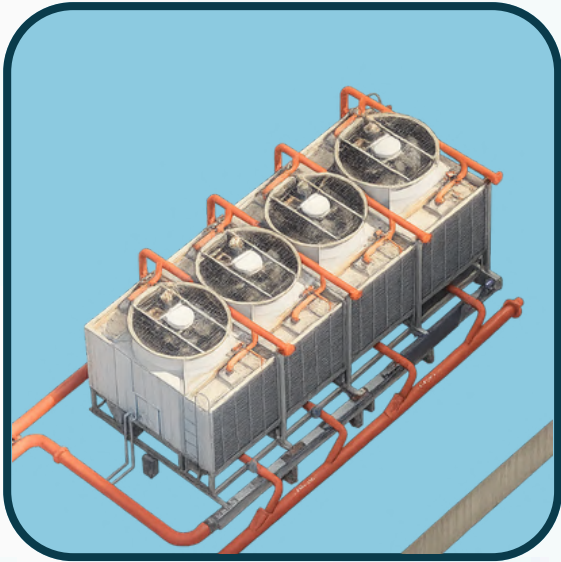
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THERMAL DESIGN



**AIR-COOLED
HEAT EXCHANGER
(ACHE)** 



**SHELL & TUBE
HEAT EXCHANGER
(STHE)** 



**THERMAL DESIGN
COMBO
(STHE & ACHE)** 



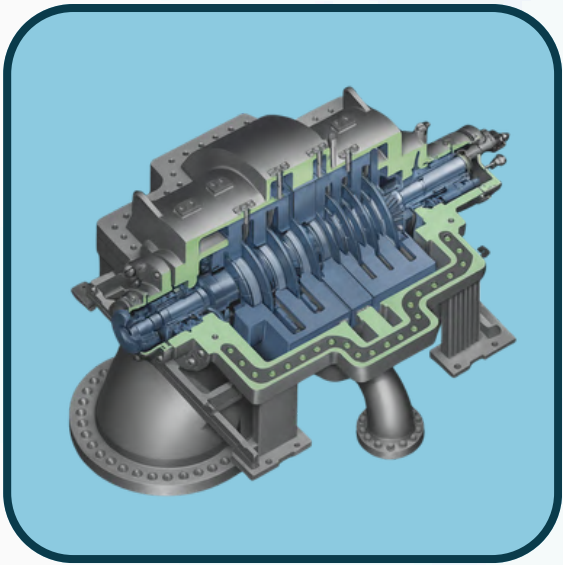
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COMPRESSOR 



CENTRIFUGAL PUMPS
IN OIL & GAS
INDUSTRY 



ROTARY EQUIPMENT DESIGN
COMBO 



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expressengineeringsolutions.com



+91 9921229232 / 7500507040



training@express-engg.com



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Sargam Tower, 1st & 2nd Floor,
Survey No - 43/1-9, Behind Girija
Hotel, DP Road, Near Rajaram
Bridge, Karvenagar, Pune - 411 052



SURAT

348, Green Palladia, Opposite Raj World,
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