COURSE OVERVIEW ME0990-4D
Bolted Flange & Gasket Design & Stress Analysis (ASME/ANSI)

Course Title
Bolted Flange & Gasket Design & Stress Analysis (ASME/ANSI)

Course Reference
ME0990-4D

Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	January 29-February 01, 2024	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
2	April 15-18, 2024	Jubail Hall, Signature Al Khobar Hotel, Al Khobar, KSA
3	July 08-11, 2024	Cheops Meeting Room, Radisson Blu Hotel, Istanbul Sisli, Turkey
4	October 14-17, 2024	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Description

This practical and highly-interactive course includes practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

In this course, we shall be analyzing the riveted and bolted joints used in the oil refineries for jointing of pipes & plates, for the blinding of pipes, pressure vessels and heat exchangers.

The selection of pipe flanges is well documented in the ASME code and is fairly straight forward when pressures and temperatures are known. Use of the code makes the specific selection of components such as flanged valves, meters, pumps and compressors also fairly straight forward in most instances.

As a piping designer or engineer it is, however, essential to have an understanding of the flange joint make-up as a unit. To this end, it is essential to understand the meaning of bolt preload and its importance in the flange joint, when considering external loadings due to (1) internal pressure, (2) cyclic conditions- leading to possible fatigue, (3) the effect of temperature, (4) shear and bending loads, and (5) vibration.

Material selection will also be discussed. Once materials have been selected for flanges, bolts and gasket, for a particular joint, the engineer should be able to specify and/ or calculate initial torque requirements and to ensure that the joint will not fail or leak.

The aspect of fatigue loadings will be covered, however in practice the cyclic conditions encountered can be extremely difficult to estimate. An example of a pipeline in Alaska will be discussed in this regard. Sometimes, at best, a designer/ engineer can only make assumptions (and judgments based on experience), regarding expected vibration. Accurate bending and shear loads on flange joints can sometimes only be established from a pipe stress analysis programme.

Only in special instances will a full finite element analysis have to be carried out for a critical joint. This is best left to the specialists and in this course no attempt will be made to teach the participants the FEA techniques (e.g. Nuclear Specials).
However, research will be discussed to illustrate the process and to give the participants some understanding of FEA techniques when applied to a flange joint. When a flange joint is subjected to critical high temperature and pressures it is always recommended to give the design to a specialist who has the necessary software available.

Circular flat plates will be analyzed and compared to blind flanges, and pressure vessel heat exchanger applications.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply a comprehensive knowledge and techniques on bolted flange and gasket design and stress analysis in accordance with ASME/ANSI Standards
- Identify the different types of flanges and gaskets used in the industry and become familiar with their applications
- Enumerate the system components of flange joint and analyze torque equations, stiffness of members, pretensioning, bolt strength, external loads and torques versus tension
- Determine the various torque requirements needed and compare theory versus manufacturer/contractor recommendations
- Analyze a joint in shear and explain fatigue loading and the effect of temperature
- Determine the system components of gaskets and their effect in the flange joint
- Employ the selection process of flanges and ratings and identify the parameters that can cause flange leakage
- Distinguish blind end flange design for both pipelines and pressure vessels
- Use ASME/ANSI charts, bolting charts and torque charts in the selection of flange components
- Recognize why FEA techniques are necessary in critical flange design applications
- Identify some of the software packages available for specific locations

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials, sample video clips of the instructor's actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides systematic techniques and methodologies on bolted flange, gasket design and stress analysis for engineers involved in the design, construction or maintenance of pressurized equipment utilizing flanged joints for the petroleum, refining, chemical, power and process industries.

Training Methodology

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Workshops & Work Presentations
30% Case Studies & Practical Exercises
20% Software, Simulators & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Fee

Abu Dhabi	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Al Khobar	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Istanbul	**US$ 5,000** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **2.4 CEUs** (Continuing Education Units) or **24 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Rod Larmour, PEng, MSc, BSc, is a **Senior Mechanical Engineer** with over **40 years** of **Onshore & Offshore** practical experience within the **Power**, **Petrochemical**, **Oil & Gas** industries. His expertise greatly covers the application of **Rotating Machinery**, **Mechanical Alignment**, **Stress Analysis**, **Thermodynamics**, **Fluid Mechanics**, **Heat & Mass Transfer Engineering**, **Air Conditioning & Refrigeration Technology**, Cooling Towers, **Gas & Steam Turbines**, **Centrifugal Compressor & Pumps** and the **design**, **failure investigation**, and **maintenance** of **Atmospheric Storage Tanks & Tank Farms** and **Bolted Flanges & Joints**.

Currently, Mr. Larmour is working with Transnet overseeing the performance and safety of several **fuel pipelines** including **pumping stations** and **inland tank farms** locally. He also takes lead in the **planning** of detailed design of a **fuel gas supply system** from a site to the **proposed new power station**, the **management** of an **EPC booster gas compressor station** including an **overland piping**, and **spearheads** the **commercial & contractual management** within the **Ilitha Process Group**.

Throughout Mr. Larmour's lengthy career, he has worked with **several international companies** like **Mobil**, **Mossgas**, **Stewarts & Lloyds** and **Ilitha** with prime positions such as **Operations Manager**, **Principal Project Manager**, **Senior Mechanical Engineer**, **Offshore Projects Manager**, **Design Manager**, **Quality Assurance Manager** and **Project Engineer**.

Mr. Larmour's experience was not only confined to the industry alone. He was also able to largely contribute his expertise and impart his knowledge in the academe. He has engaged himself with **researches** and **lectures** in for several **universities** and **companies** and has held numerous **training courses** on **Thermomechanics** & **Fluid mechanics**, **Engineering Design**, **Refrigeration & Air Conditioning** and **Heat Transfer**.

Mr. Larmour is **Registered Professional Engineer** and has **Master** & **Bachelor** degrees in **Mechanical Engineering** and has a **Diploma** in **Nuclear Science**. Further, he is a **Certified Instructor/Trainer**.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	**PRE-TEST**
0830 – 0900	**Introduction & Course Overview**
0900 – 0930	**Types of Flanges & Gaskets Used in the Industry**
0930 – 0945	Break
0945 – 1100	**Power Screws–Basic Theory Summary** Torque Equations • Stiffness of Members • Pretensioning • Bolt Strength • External Loads • Torque vs. Tension
1100 – 1215	**Bolt Strength and Preload–Theory & Examples**
1215 – 1230	Break
1230 – 1330	**Torque Requirements & Examples**
1330 – 1420	**Tutorial**
1420 - 1430	**Recap**
1430	Lunch & End of Day One

Day 2

0730 – 0830	**Gaskets & their Effect in the Flange Joint**
0830 – 0930	**Flange Joints in Shear & Examples** Fatigue Revision
0930 – 0945	Break
0945 – 1100	**The Effect of Temperature**
1100 – 1215	**Fatigue Loading of Tension Joints & Examples**
1215 – 1230	Break
1230 – 1330	**Tutorial**
1330 – 1420	**Selection of Flanges & Ratings**
1420 - 1430	**Recap**
1430	Lunch & End of Day Two

Day 3

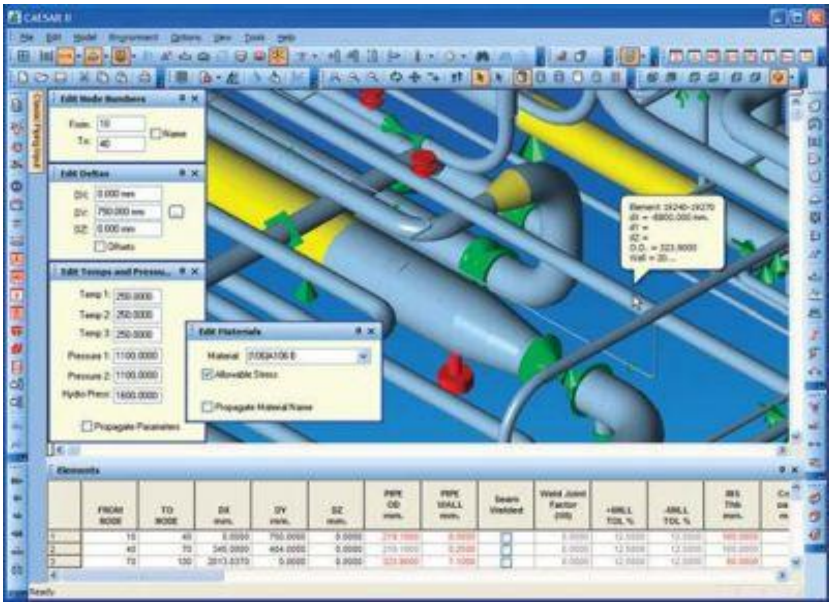
0730 – 0930	**Bolted Joints in Shear**
0930 – 0945	Break
0945 – 1100	**Application in Pressure Vessels–Circular Flat Plate Theory & Examples**
1100 – 1215	**Use of ASME/ANSI Charts, Bolting Charts & Torque Charts** Torque Charts vs. Tension
1215 – 1230	Break
1230 – 1330	**Causes of Flange Leakage**
1330 – 1420	**Tutorial**
1420 - 1430	**Recap**
1430	Lunch & End of Day Three

Day 4

0730 – 0800	***Special Cases of Flange Design***
0800 – 0900	***Introduction to Finite Element (FE) Analysis of a Flange Joint Under the Combined Effect of Preload, Pipe Internal Pressure & Temperature***
0900 – 0930	***Why Joints Fail***
0930 – 0945	*Break*
0945 – 1100	***Discussion Around Various Aspects***
1100 – 1215	***Standard Procedures for the Assembly of Flange Joints***
1215 – 1230	*Break*
1230 – 1300	***Practical Question Time***
1300 – 1345	***More Worked Examples***
1345 - 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the state-of-the-art "CAESAR II Software".



Course Coordinator

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