POWERMASTER
CONTROLLED BOLTING SOFTWARE

SOLUTIONS FOR EVERY BOLTING APPLICATION

USER MANUAL

POWERMASTER

AN EXPRESS WAY FOR EASE OF BOLT LOAD CALCULATION AND DOCUMENTATION.

Contents

Minimum System Requirements:

- Operating system: Windows 7 and above
- Disk Space: Minimum 1 GB
- Processor: Intel dual core or equivalent
- Screen Resolution: 1366 x 768
- RAM : Minimum 512 MB

Instruction for installation:

- First screen informed about copy right, system requirement, and end user license agreement. Press NEXT button.
- Press browse button, select the drive other drive if limited permission available for default location in 'C' drive. Press NEXT button.
- Press NEXT button.
- Click on create desktop shortcut. Press NEXT
- Click on install button.
- Select full installation (for Sqlite). Click on NEXT.
- Select checkbox for "Generate native images for the assemblies & install them into native image cache" also select the checkbox for "Install the assemblies into the global assembly cache". (This is very important as Sqlite has to be in GAC (Global Assembly Cache) to run this software)
- Click NEXT.
- Click NEXT.
- Finish.

Introduction

Powermaster Bolting Software "CBex" helps users to calculate bolt tensioner pressures for specific bolt joint application and to prepare documentation for the same. User need to feed the minimum essential data to get the necessary details for application using specific tool from Powermaster. It helps to create Job sheet for a specific application as well as summery Sheet / Job Register for multiple jobs of a specific project. The software contains data for the following standard bolted flanges.

- ANSI B16.5
- ANSI B16.47
- API 6A

Notes:

It contains data for the Subsea TSS Series & Topside PST Series of Powermaster Bolt Tensioning Tools. The software has been developed completely in-house by Powermaster and as such we have the ability to implement changes and add additional features.

We would hope that our partners that use the software help us by making suggestions and reporting any problems they encounter with the software.

Caution: The recommended values are based on the experience and are used without any guarantee or liability to Powermaster. The recommended bolt stress values assume that flange material yield strength is equal to or greater than 247N/mm^2 (35840lbs/In^2).

DO NOT USE THE RECOMMENDED ANSI B16.5 BOLT STRESS VALUES FOR FLANGES MANUFACTURED WITH MATERIAL YIELD STRENGTH LESS THAN 247N/mm^2 (35840lbs/In^2)

The following flange materials or equivalents are suitable for the recommended bolt stresses

- ASTM A105
- ASTM A182 Grades -F65, - F60, -F52 & -F51
- ASTM A350 Grade -LF2& -LF3
- ASTM A694 Grade F52, 60 & -F65

Flange Service Temperature range for the recommended bolt stress values are -101ºc to +200ºc. or as limited by the piping class specifications or the bolt minimum or maximum temperature specification. Do not use the recommended bolt stress values outside of this range

This software helps user to create a project with multiple joint application.

Basic working on software is to first create a Project. Then add multiple applications as applicable.

Toolbars

Project Toolbar:

Refer below project bar for setting up a new project and working on it.

1.		To add a New Project	4.		To save the Project
2.		To Open an Existing Project	5.		To close the Project
3.		To edit an open existing project	6.		To delete the project

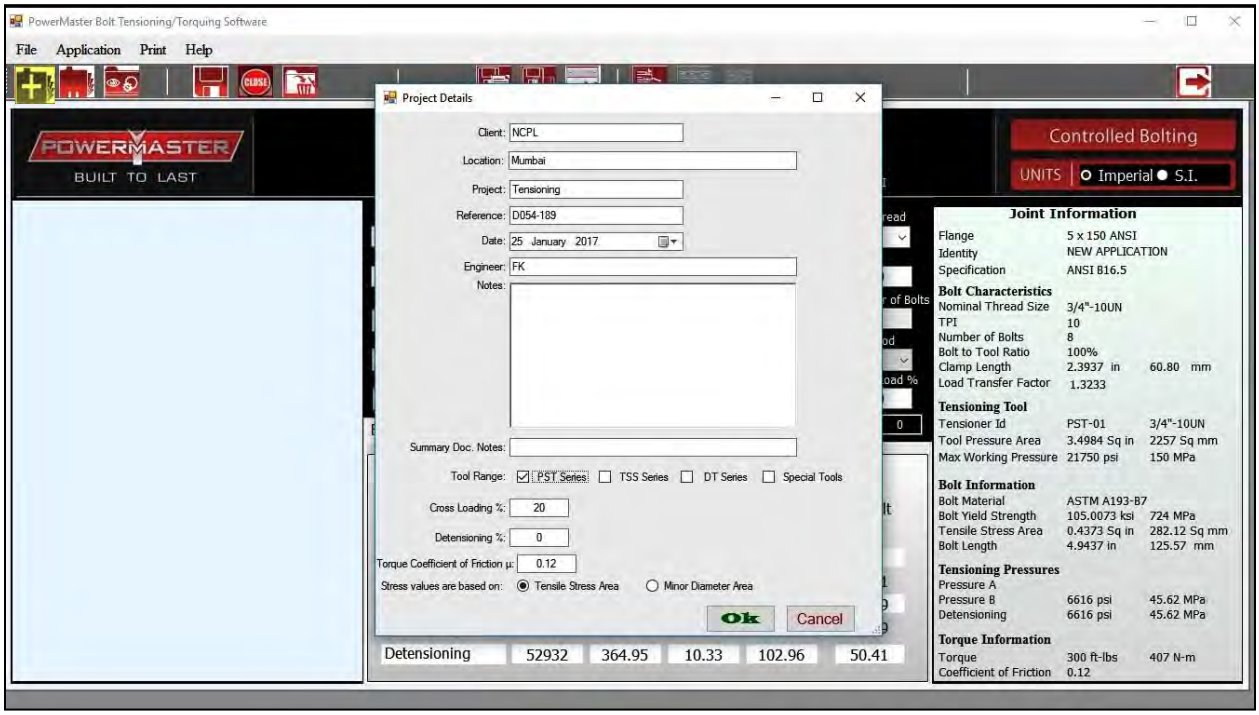
Application Toolbar:

Using Application data sheet, applications are added to a project, using below application bar.

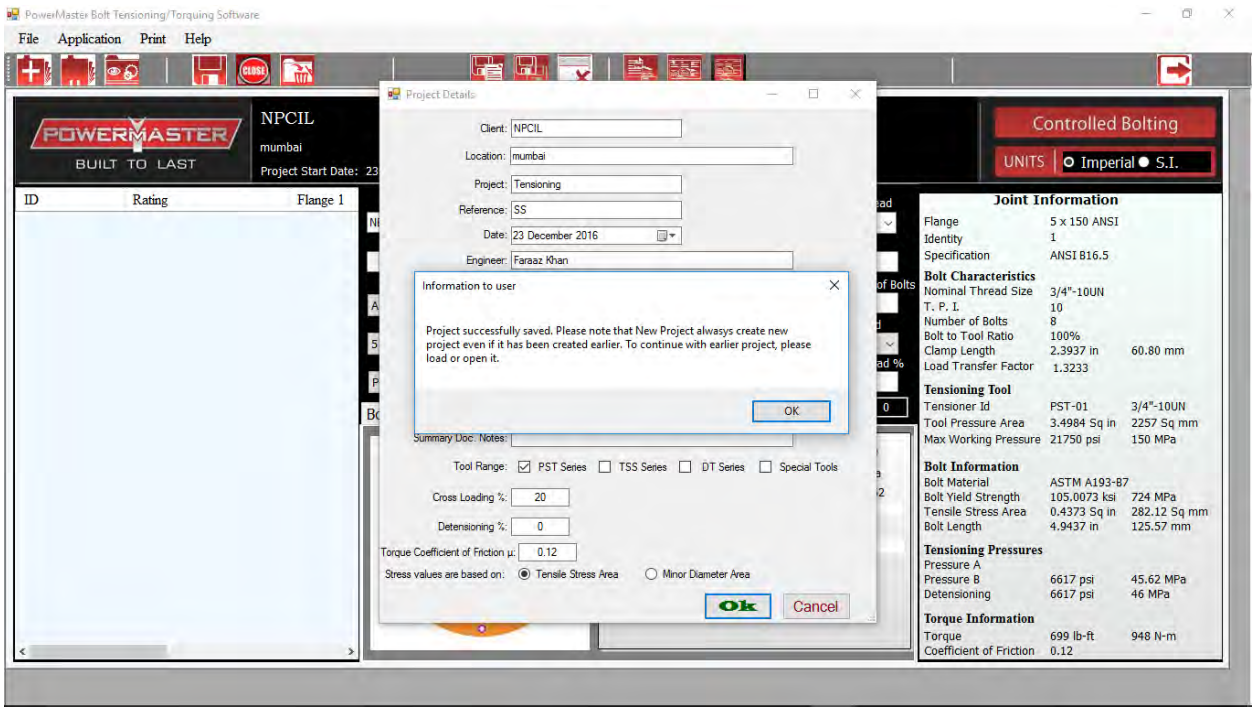
1.		Save application as New	4.		View application details
2.		Save or Over write application	5.		View applications in Grid form of an project.
3.		Delete application	6.		View application and Joint Summary sheet/ Report.

Setting up a project:

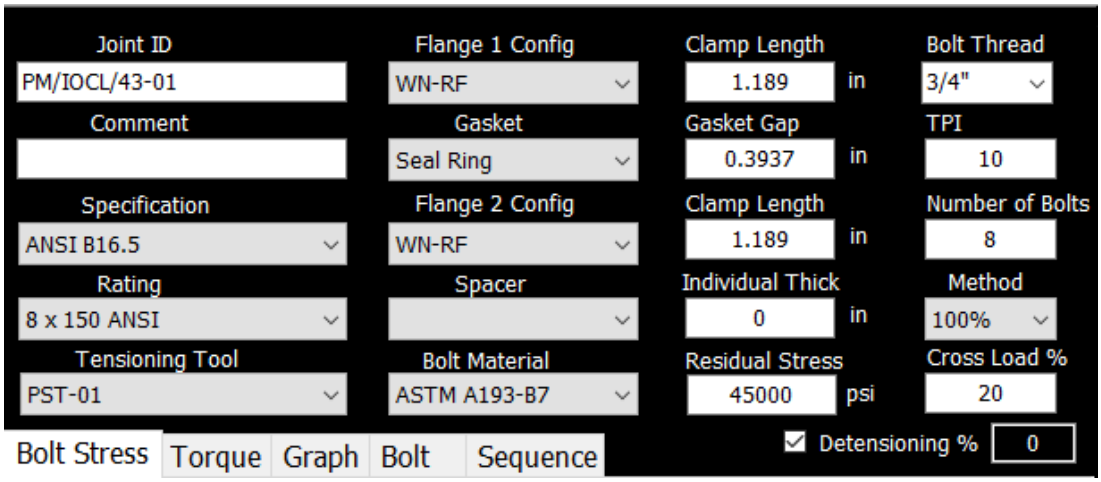
Click on icon"  ", and enter project details.



Close it by clicking on **"OK"**



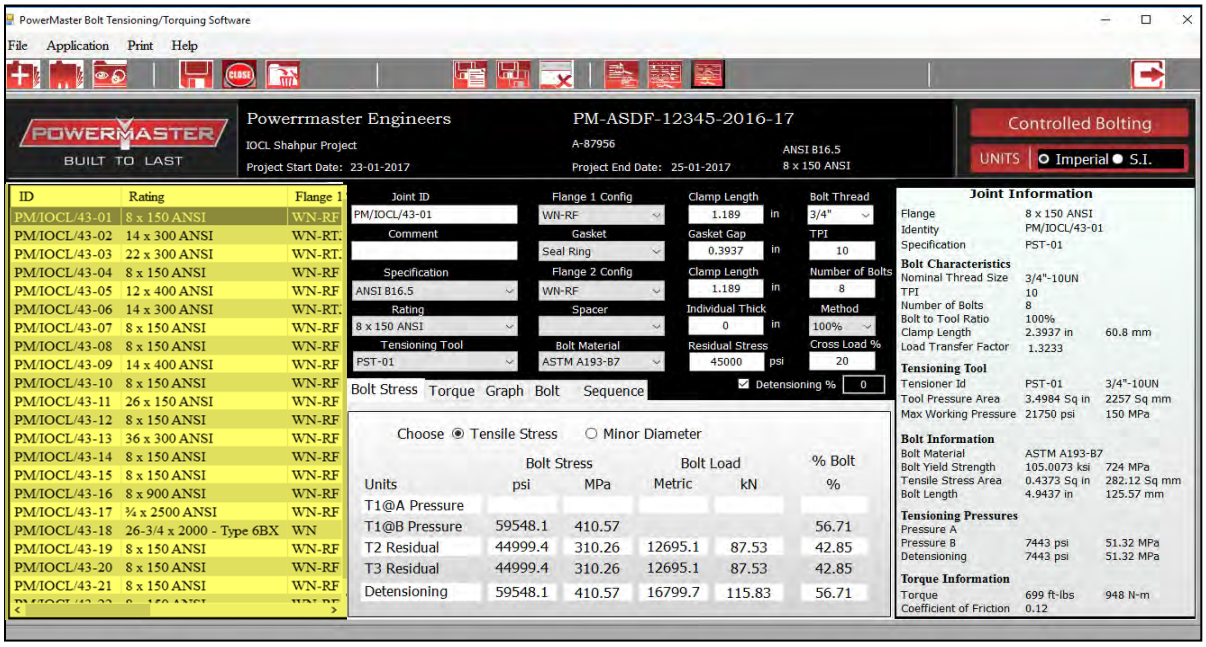
Setting up your first application:



- Provide an identification no. / serial no in ‘’Joint ID’’.
- Enter any comment if required.
- Select Flange specification.
- Select flange w.r.t. to its size and rating.
- Check for bolt specification in bolt thread, change if required.
- Select Tool to be used for the application.
- Confirm Flange-1 configuration & then select gasket.
- Select Flange -2 configuration .Add spacer details if applicable.
- Select bolt material from dropdown list and change Residual stress if required.
- Select Application Method i.e. 25%, 50%, 100% or Torque application.
- Select De-tensioning if required and enter the percentage above residual load it need to be set.
- Save this application using icon "  ".
- Add as many as applicable applications for the project. To edit an application use icon "  ".

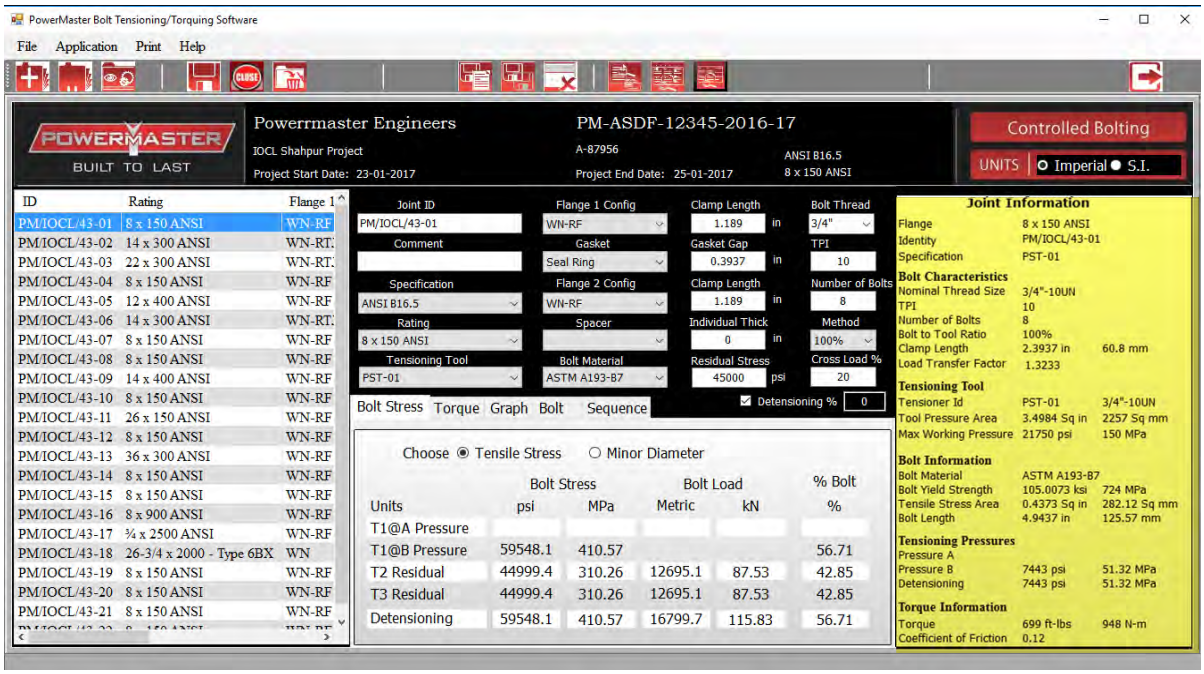
Project Application List

All applications related to project are displayed in this area. An application can be selected and edited from here.

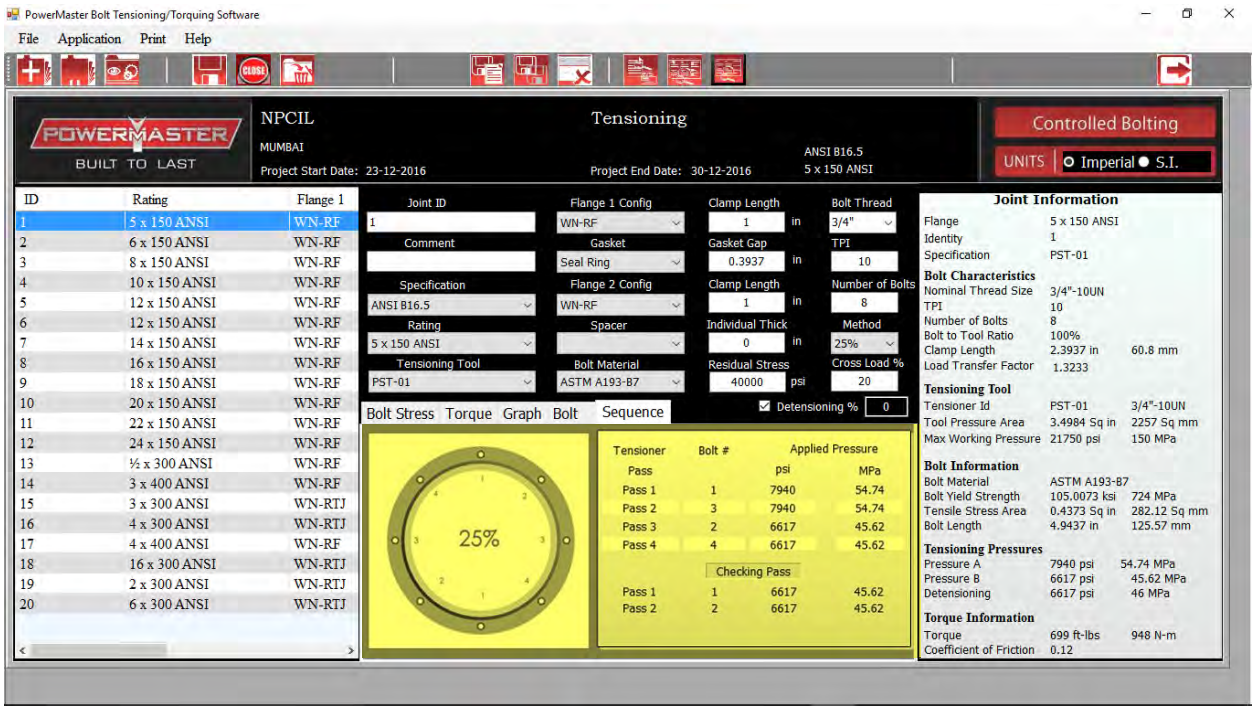


Joint Information & Calculation Data.

This area is where the current bolted joint information is with load application data is displayed.



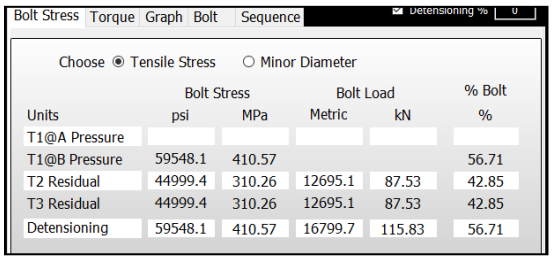
Information Tab Bar



The information tab bar consists of 5 Tabs,

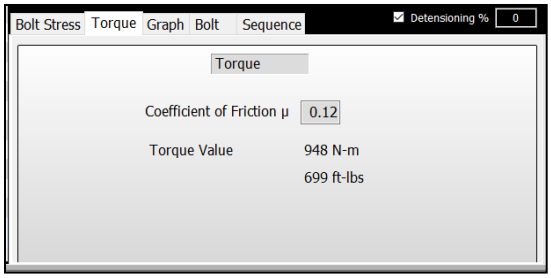
- Bolt Stress
- Torque
- Graph
- Bolt
- Sequence

Bolt Stress Tab:



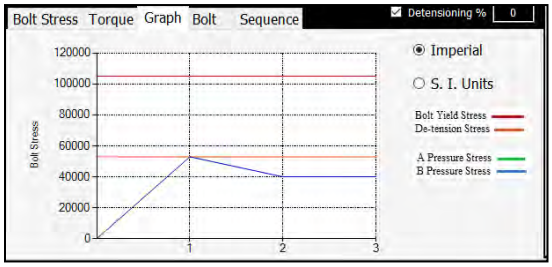
- Displays Bolt Stress, Bolt Load and % Bolt Yield over a 3 stage time period.

Torque Tab:



- This tab displays the torque value to achieve the residual bolt load based on the displayed coefficients of friction.
- The global coefficient of friction value can be edited in the project definition window.

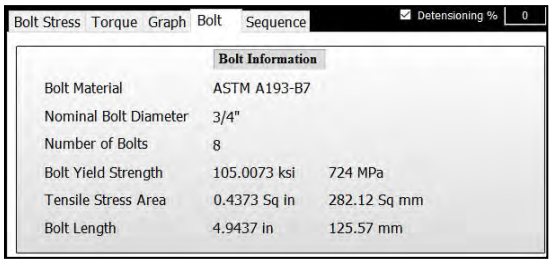
Stress Graph Tap:



This tab displays the predicted bolt stress path over a 3 point time period.
T0 = Unstressed bolt
T1 = Initial bolt stress A pressure
T1 = Initial bolt stress B pressure
T2 = Final residual bolt stress

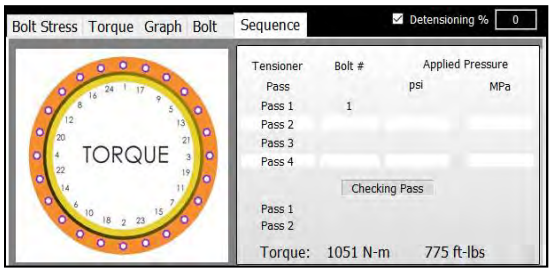
- The Red line indicates the yield strength of the bolt
- The orange line indicates the maximum detensioning stress.

Bolt Details Tab:



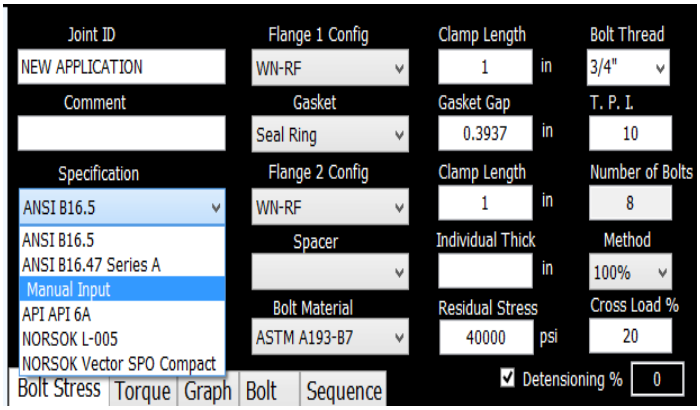
- This tab displays the bolt detail

Tightening Sequence Tab:

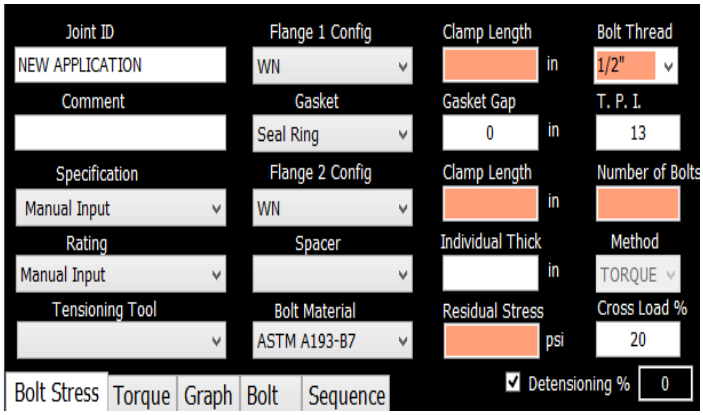


- This tab displays the recommended torque application sequence.
- Final Torque Value is displayed in Both ft lbs & Nm

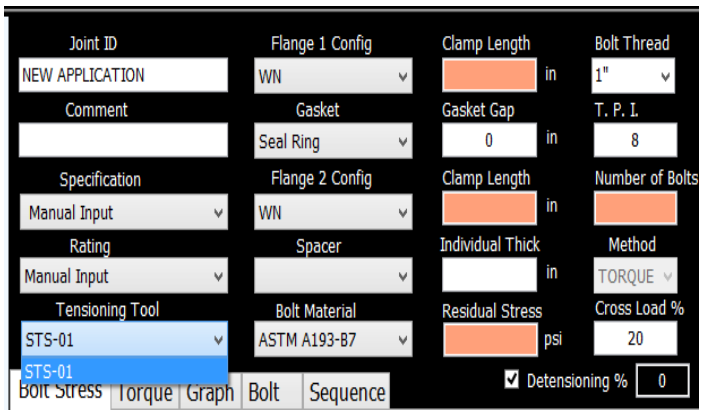
Manual Input Mode



- Manual Input mode can be chosen from the Specification menu.
- Manual input mode is used application having non standard joints.
- In this mode below values are to be entered manually :-
    - Flange 1 data
    - Flange 2 data
    - Bolt Size / thread
    - Number of bolts
    - Residual Stress



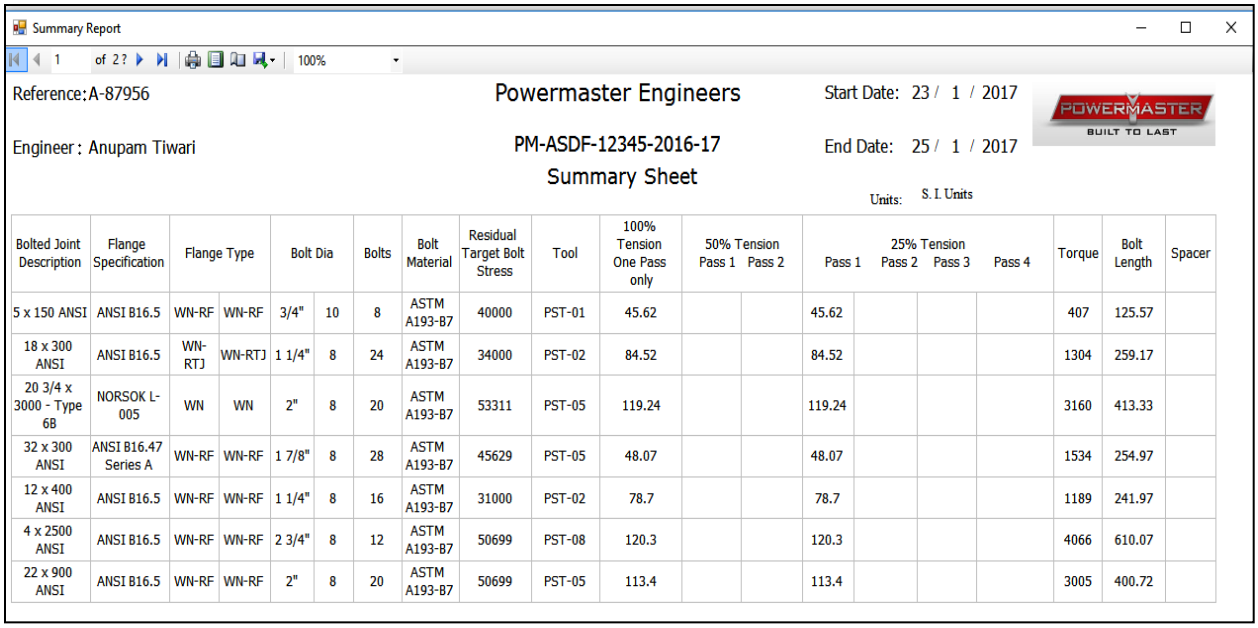
- All the 5 orange coloured fields in the application definition area are to be filled first before the joint inspector displays the result.
- It is recommended to select values in sequence .
- Once the thread is selected the software will suggest tensioning tools in the tensioning tool menu



- The Tensioning Tool menu will display the tools for the selected bolt thread size. The tools include the special tool created by the user along with the standard tool range.
- The special tool can be created by the user in the file menu/special tool library.

Summary Report

To view summary report of project select on icon "  "



Summary Report

Reference:A-87956 — Powermaster Engineers — Start Date: 23 / 1 / 2017

Engineer : Anupam Tiwari — PM-ASDF-12345-2016-17 — End Date: 25 / 1 / 2017

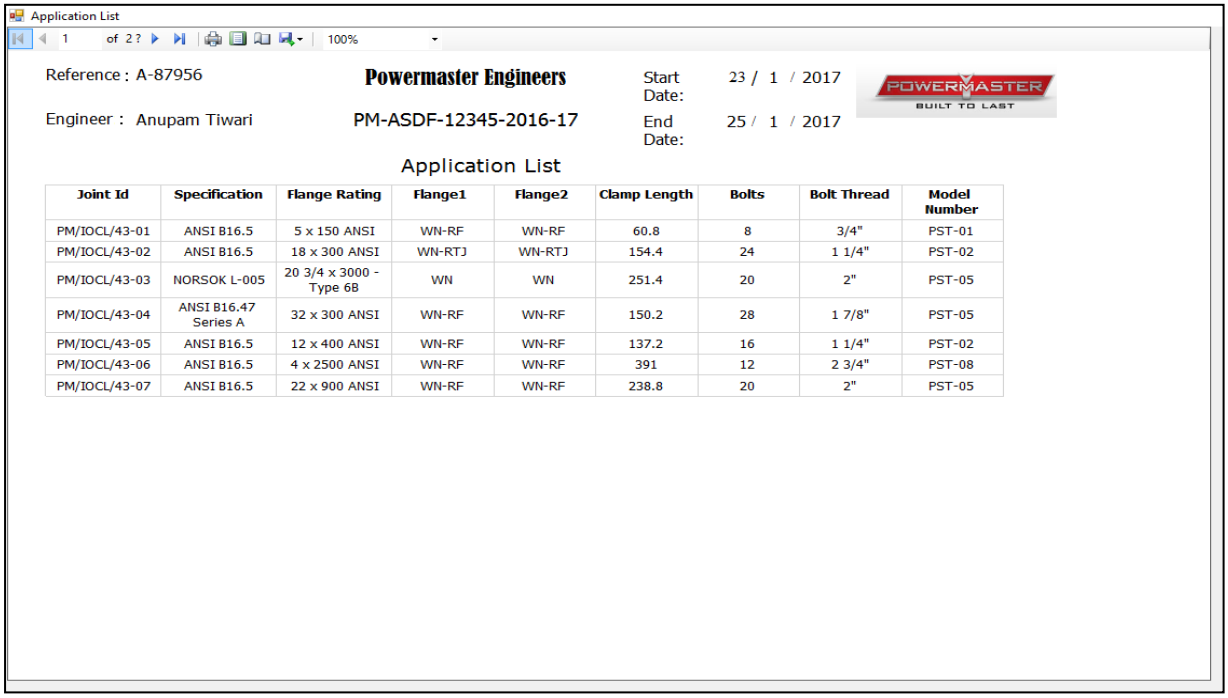
Summary Sheet

Units: S. I. Units

Bolted Joint Description	Flange Specification	Flange Type		Bolt Dia		Bolts	Bolt Material	Residual Target Bolt Stress	Tool	100% Tension One Pass only	50% Tension Pass 1	50% Tension Pass 2	25% Tension Pass 1	25% Tension Pass 2	25% Tension Pass 3	25% Tension Pass 4	Torque	Bolt Length	Spacer
5 x 150 ANSI	ANSI B16.5	WN-RF	WN-RF	3/4"	10	8	ASTM A193-B7	40000	PST-01	45.62			45.62				407	125.57	
18 x 300 ANSI	ANSI B16.5	WN-RTJ	WN-RTJ	1 1/4"	8	24	ASTM A193-B7	34000	PST-02	84.52			84.52				1304	259.17	
20 3/4 x 3000 - Type 6B	NORSOK L-005	WN	WN	2"	8	20	ASTM A193-B7	53311	PST-05	119.24			119.24				3160	413.33	
32 x 300 ANSI	ANSI B16.47 Series A	WN-RF	WN-RF	1 7/8"	8	28	ASTM A193-B7	45629	PST-05	48.07			48.07				1534	254.97	
12 x 400 ANSI	ANSI B16.5	WN-RF	WN-RF	1 1/4"	8	16	ASTM A193-B7	31000	PST-02	78.7			78.7				1189	241.97	
4 x 2500 ANSI	ANSI B16.5	WN-RF	WN-RF	2 3/4"	8	12	ASTM A193-B7	50699	PST-08	120.3			120.3				4066	610.07	
22 x 900 ANSI	ANSI B16.5	WN-RF	WN-RF	2"	8	20	ASTM A193-B7	50699	PST-05	113.4			113.4				3005	400.72	

Application List

To view all application details in the project select on icon "  "



Application List

Reference : A-87956 — Powermaster Engineers — Start Date: 23 / 1 / 2017

Engineer : Anupam Tiwari — PM-ASDF-12345-2016-17 — End Date: 25 / 1 / 2017

Application List

Joint Id	Specification	Flange Rating	Flange1	Flange2	Clamp Length	Bolts	Bolt Thread	Model Number
PM/IOCL/43-01	ANSI B16.5	5 x 150 ANSI	WN-RF	WN-RF	60.8	8	3/4"	PST-01
PM/IOCL/43-02	ANSI B16.5	18 x 300 ANSI	WN-RTJ	WN-RTJ	154.4	24	1 1/4"	PST-02
PM/IOCL/43-03	NORSOK L-005	20 3/4 x 3000 - Type 6B	WN	WN	251.4	20	2"	PST-05
PM/IOCL/43-04	ANSI B16.47 Series A	32 x 300 ANSI	WN-RF	WN-RF	150.2	28	1 7/8"	PST-05
PM/IOCL/43-05	ANSI B16.5	12 x 400 ANSI	WN-RF	WN-RF	137.2	16	1 1/4"	PST-02
PM/IOCL/43-06	ANSI B16.5	4 x 2500 ANSI	WN-RF	WN-RF	391	12	2 3/4"	PST-08
PM/IOCL/43-07	ANSI B16.5	22 x 900 ANSI	WN-RF	WN-RF	238.8	20	2"	PST-05

Individual Application Report

To view individual application report click on icon"  "

Client	Trilok Fabrication N Engt
Project	HPCL Mumbai
Project Reference	
Engineer	Anupam Tiwari

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Bolt Tensioning

Flange	44 x 150 ANSI
Specification	ANSI B16.47 Series A
Identity	100

Project Start Date: 3 / 11 / 2016
Project End Date: 15 / 12 / 2016

Joint Information		Flange Configuration		
Nominal Thread Size	1 1/2"	F1	104.62	WN-RF
TPI	9	Gap	9.9982 mm	
Number of Bolts	40	F2	104.52 26 mm	WN-RF
Bolt Tensioning Ratio	25%	Spacer	0 mm	

Bolt Material		
Bolt Yield Strength	**105 ksi**	**724 MPa**
Tensile Stress Area	**1.7571 Sq in**	**1133.62 Sq. mm**
Bolt Length	**13.465 in**	**342.01 mm**

Tensioner Pass	Bolt #	Applied Pressure psi	Applied Pressure MPa
Pass 1	1	15125	104.28
Pass 2	3	15125	104.28
Pass 3	2	12604	86.9
Pass 4	4	12604	86.9
Checking Pass			
Pass 1	1	12604	86.9
Pass 1	1	12604	86.9

Tensioning Tool			Torque		
Proposed Tensioning Tool	PST-03		Torque	930 lb-ft	1261 N-m
Tool Pressure Area	6.6015 Sq in	4259 Sq mm	Coefficient of Friction μ	0.12	

Bolt Stress			Bolt Load		% of Bolt Yield
Tensile Stress Area	psi	MPa	Metric Ton	kN	%
T1 @ A Pressure	56823	391.78	64416	444.13	54.11
T1 @ B Pressure	47352	326.48	53678	370.1	45.09
T2 Residual	40000	275.79	45345	312.64	38.09
Stress @ Detensioning	47352	326.48	53678	370.1	45.09

Tensioning Pressure	First Pass		Second Pass		% of Bolt Yield
	psi	MPa	psi	MPa	%
100% Tensioning	0				45.09
50% Tensioning	15125	104.28	12604	86.9	54.11
Max. Detensioning	12604	86.9			45.09

Signed on behalf of	Signed on behalf of	Comment
Date:	Date:	
Name:	Name:	
Signature	Signature	

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