

A photograph of several tall, vertical industrial distillation columns or pressure vessels, likely in a refinery or chemical plant. The columns are made of metal and have various pipes, ladders, and platforms attached to them. The background is a clear blue sky.

# **MT-VESS**

## **MECHANICAL DESIGN OF PRESSURE VESSEL**

### **MT-MECH: MECHANICAL CODES AT YOUR FINGERTIPS**

A COMPLETE SUITE OF PROGRAMS FOR MECHANICAL DESIGN IN CHEMICAL ENGINEERING

- MT-EXCH SHELL & TUBE HEAT EXCHANGERS
- MT-VESS HORIZONTAL & VERTICAL VESSELS
- MT-COMP EXCHANGERS & VESSELS COMPONENTS
- MT-LAYOUT TUBESHEET LAYOUT ANALYSIS

MT-VESS allows the mechanical design and the stability check of horizontal/vertical pressure vessels. Rating of existing pressure vessels is also allowed.

The following main functions are provided:

- Calculation of thicknesses and dimensions of all vessels components.
- Assembling and geometrical sizing of the vessel as a whole.
- Vessel stability check.



### ALLOWED CODES

- ASME VIII division 1 (U.S.A.)
- ASME VIII division 2 (U.S.A.)
- AD2000-MERKBLATT (Germany)
- ISPEL-VSR (Italy)
- EN 13445 (Europe)
- EN 12493 (LPG) (Europe)
- EN 14025 (LPG) (Europe)
- PD5500 (App. G) (U.K)

### ALLOWED COMPONENTS

The following components can be analyzed by the program, as individual components or assembled in a complete vessel configuration:

- Formed Heads (Spherical, Elliptical, Torispherical)
- Flat Heads (Welded, Flanged)
- Cylindrical Shells
- Conical Sections
- Girth Flanges
- Nozzles (Radial, Inclined, Hillside)
- Support (Saddles, Legs, Brackets and Skirt)

### ELEMENT TYPE

In order to allow maximum freedom in defining complex vessel and to guarantee complete consistency of the defined configuration, the following elements are available:

MAIN                      Structural resistant elements

INTERMEDIATE	Elements to divide the vessel in different pressure chambers
APPENDIX	Elements with axis orthogonal to the main vessel axis
JACKET	Elements for heat exchanging with external fluids

### ANALYSIS CAPABILITIES

MT-VESS is a powerful, full featured program, that allows engineers, estimators, manufacturers to perform quick and accurate analysis on vessels components and/or on the entire vessel.

- **Internal pressure calculation.**

All the vessel components are calculated to the internal conditions of design and hydraulic test. For each element, the user can specify two different pressure and temperature conditions to be verified.

- **Geometrical sizing of the vessel.**

The program provides for a comprehensive geometrical sizing including all the quotas, distances and dimensions of each component and of the vessel as a whole.

- **Weight calculation.**

The program calculates the weight of each component and the weight of the vessel in the following condition: operation, hydraulic test, erection, fabricated. Internal elements (demister, catalysts, distillation trays, liquid distributors, packing, inert or coatings) are taken into consideration in weight calculation.

- **Check to the external pressure**

The program automatically verifies the equipment for external pressure and, if necessary, installs stiffening rings, increases thickness or combines both operations according to the user specifications.

- **Stability check**

The program performs the stability check to the combined effects of forces and moments generated by the vessel weight, by the wind and earthquake loads, and by forces and moments specified by the user.

The wind and earthquake analysis can be carried out according to the following codes:

**WIND**

- ANSI
- ASCE 7-10
- ASCE 7-16
- BSI CP3
- CNR 1982
- CNR 1996
- DM 2005
- EUROCODE 1
- NEIGE ET VENT
- NTC/DM2018
- UBC 1994
- UBC 1997
- MEXICO V. 2008
- USER

**EARTHQUAKE**

- ANSI 1982
- ASCE 7-10
- ASCE 7-16
- CNR 1986
- DM-2005/OPCM-3274
- EUROCODE 8
- PARASISMIQUE PS92
- NTC/DM2018
- UBC 1994
- UBC 1997
- MEXICO S. 2008
- USER

• **Supports positioning and stability checks**

The resultant forces and moments are applied to the supports for checking stability and calculating loads acting over the foundations.

• **Nozzle opening check**

Program automatically add reinforcing pad or increase nozzle thickness

• **Local loads analysis**

For all nozzles the local load analysis can be performed according to the following codes: WRC 107/ WRC 297/ BS 5500/ H.E.I/ EN 13445

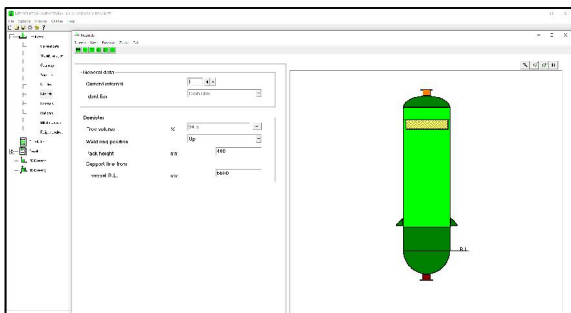
• **Vibration Analysis**

• **Column lifting analysis**

**INPUT**

Data entry quick and easy.

The vessel is defined interactively adding one-by-one all components (included supports, nozzles and internals) selecting them from icon tabs in the command line. The vessel is automatically redrawn after each operation for checking the results.



The majority of data are preset and the user simply selects from a list.

When needed, drawings are associated to the input fields to make the selection even easier.

Extended data banks available in the program:

- **MATERIALS**  
Mechanical properties for over 850 materials (ASME/ EUROMARK)
- **NOZZLES (PIPES AND FLANGES)**  
Tables include data for nominal diameters ranging from 10 mm (3/8”) to 1500 mm (60”) (ASA and UNI/ISO)
- **GASKETS**  
Tables include data for 80 gaskets (ASME/VSR/EN/ AD-MERKBLATT)
- **ASME CHARTS FOR EXTERNAL PRESSURE**  
All the charts provided by the ASME are included
- **STANDARD SUPPORTS**  
Tables include data for saddle, brackets, legs and skirt
- **SHAPES FOR STIFFENING RINGS**  
Tables include EUROPEAN STANDARD and AISC STANDARD
- **BOLTS**  
ANSI B18.22; UNI/ISO; DIN 2510; TEMA Tab D5/D5M

All data, common to a project, can be stored and shared by all the vessels belonging to the same project.

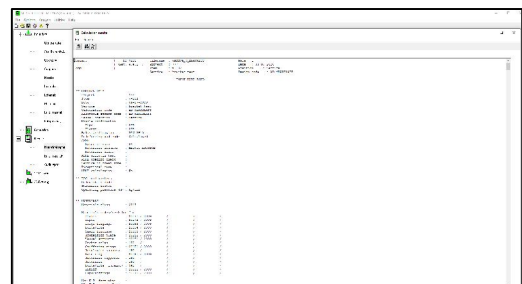
Measurement Units are completely free and customizable. The user can insert new units, define new unit systems or modify on the fly a single unit on the input data sheet.

**OUTPUT**

Report results clear and exhaustive.

• **TABULAR REPORT**

All the data of the vessel are printed out including the results of numerical calculation and geometrical dimensions.



• **BILL OF MATERIAL**

All components belonging to the vessel under design are summarized in a table with dimensions, weights, number of items. Table can be viewed on screen, printed or exported as Excel file for further processing.

• **AUDIT REPORTS BOOK**

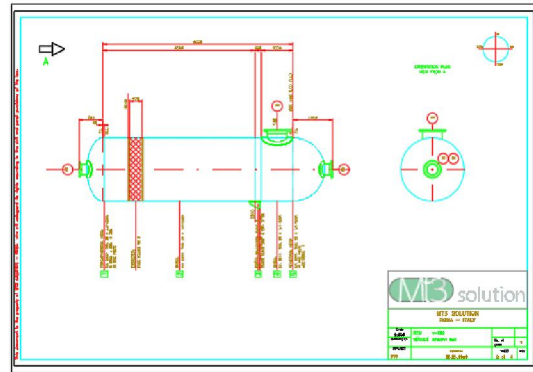
For all the vessel components datasheets reporting formulas are shown on the screen and can be printed.

Datasheets can be produced in English or Italian languages, in S.I. or English system of measurement units.

<b>Company</b>		Project: 777		Rev: v-102		Date: 03-07-2020	
<b>Logo</b>		Calculation Code: AD 2000-MERKBLATT - Updates July 2012		Paragraph: B0		ASME materials archive: ASME II-Part D - METRIC - E2010	
		Calcut. Datasheet: Nozzle 1N		Sh. 2 of 6			
		Construction: SET IN Reinforce: RAD Wall: TORISPHER HEAD Material: Vessel: SA 516 GR 60-K02401 Nozzle: SA 516 GR 60-K02401 Reinf. pad: SA 516 GR 60-K02401 Int. Lining: Ext. Lining:					
<b>OPENING CHECK</b>							
Nozzle: 1N							
P	- Pressure	2.452	MPa	Di	- Nozzle int. diam.	305.85	mm
T	- Temperature	250	°C	St	- Nozzle thickness	0	mm
Dw	- Wall int. diam.	2000	mm	tt	- Nozzle allow stress	121.333	MPa
Sw	- Wall thickness	32	mm	tt	- Nozzle tolerance	0.3	mm
KW	- Wall yield	182	MPa	Cl	- Nozzle int. corrod.	-	mm
tw	- Wall tolerance	0.3	mm	CoL	- Nozzle ext. corrod.	-	mm
Dw	- Wall int. corrod.	-	mm	Pl	- Nozzle int. lining	-	mm
Cw	- Wall ext. corrod.	-	mm	Rpl	- Nozzle ext. lining	-	mm
Plw	- Wall int. lining	3	mm	L	- Pipe height	119.825	mm
Rw	- Wall ext. lining	-	mm	Lp	- Pad length	68.075	mm
qs	- Distance from border	870.075	mm	Sp	- Pad thickness	29	mm
ac	- Angle with normal	-	°	KP	- Pad yield	182	MPa
w1	- Weld leg (outward nozzle)	-	mm	ip	- Internal inspection	-	mm
w3	- Weld leg (inward nozzle)	-	mm	w2	- Weld leg (outer pad)	-	mm
				Lo	- Reinf. limit on the wall	-	mm
				lo	- Reinf. limit on the nozzle	-	mm

The measurement system units of the drawings are user definable.

The drawing is generated in DXF format and can be imported by the most common and diffused CAD programs (AUTOCAD, MICROSTATION etc.). This gives the user the further possibility to manage the drawing in order to modify or add details according to its own standards.

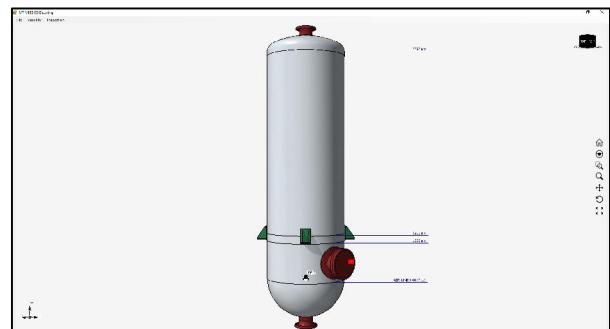


• **3D MODEL**

A 3D model is automatically generated by the program. Description language and measurement system are user definable.

Each type of component is built on different layers and can be visible or hidden by a click.

3D model export in DWG format is also available.



• **2D DRAWINGS**

Two or more sheets are automatically generated by the program, depending from the vessel complexity:

- Tables sheet (design data, loads on foundation, materials, nozzles, general notes, etc)
- General view of the vessel (front and side view, scaled in order to show relative dimensions of vessel components)
- Nozzle and internal details
- Appendices details

Drawing can be generated in English or in Italian language (Additional languages can be easily implemented).