



MT-EXCH

MECHANICAL DESIGN OF SHELL & TUBES HEAT EXCHANGERS

The software program MT-EXCH allows the mechanical design/rating and the stability check of Shell & Tubes Heat Exchangers (TEMA).

The program runs under WINDOWS 9x/NT/2000/XP operating systems and includes the following main features:

- Thickness determination and geometrical dimensioning of all exchangers components
- Assembling and geometrical dimensioning of the exchanger as a whole

ALLOWED CODES	
ASME VIII division 1	(U.S.A.)
AD-MERKBLATT	(Germany) - Harmonized with the PED directive
ISPESL - VSR	(Italy) - Harmonized with the PED directive
EN13445	(European Code)
TEMA	(U.S.A.) R, C, B classes recommendations are applied when procedures are not covered by Codes.
PD5500 (App.G)	(U.K.) (brackets and local loads)

EXCHANGERS TYPES
<p>With reference to the TEMA nomenclature, the program MT-EXCH is able to calculate exchangers including any allowed combination of the following main components:</p> <ul style="list-style-type: none"> • Channel (A/B/N) • Shell (E/F/G/H/J/K) • Rear End (L/M/N/S/T/U) <p>Both Channel and Rear End can be conical.</p>

EXCHANGER COMPONENTS
All components that are part of an exchanger are dimensioned by the program:

- Welded Formed Heads (elliptical, spherical, torispherical)
- Flat Flanged Heads
- Shell Barrels
- Conical Sections
- Girth Flanges
- Tubesheets
- Expansion Joints
- Floating Head (flange and cover)
- Nozzles

SUPPORTS

- Saddles (for horizontal exchangers)
- Brackets (for vertical exchangers)

NOZZLES

- Nominal Diameters from 10 to 1500 mm (from 3/8" to 60")
- Automatic Selection of the construction material from pipe or shell
- Automatic verification of the nozzle hole and reinforcement calculation

DATA BANKS	
	The software package is based on large, user modifiable, data banks:
Materials	mechanical properties of over 350 ASME/UNI/EUROMARK materials
Nozzles and Flanges	(ASA, UNI)
Gaskets	(ASME/VSR, AD-MERKBLATT)
ASME Charts for External Pressure	
Standard Supports	Saddles, Brackets
Stiffening Rings	AISC, EUROPEAN
BOLTS	ANSI B18.22, UNI/ISO, DIN 2510

ANALYSIS CAPABILITIES

•	<p>Check of stresses caused by internal pressure All the exchanger components, shell and tubes sides, are dimensioned for internal pressure and hydraulic test. The components who are in contact with both fluids (shell and tube) are automatically checked for pressure acting on the external side.</p>																		
•	<p>Geometrical Dimensioning of the Exchanger. The program provides for a comprehensive geometrical dimensioning, including all quotas, distances, and dimensions of each component and of the exchanger as a whole. Referencing to well defined and universally accepted constructive Standards, included in MT-EXCH, the rated Setting Plan of the exchanger is automatically produced.</p>																		
•	<p>Weight Calculation. The weight of each component is calculated and the following additional items are provided:</p> <ul style="list-style-type: none"> • Empty weight of the exchanger • Weight of the tubes bundle • Weight of the exchanger full of water 																		
•	<p>Stability check for loads caused by external pressure. To contrast the external pressure the user can choice between stiffening rings insertion, thickness increase or a combination of both.</p>																		
•	<p>Stability check against combination of different loads: Equipment weight, wind loads, earthquake, user specified forces and/or moments. For Wind and Hearthquake the user can choice between the following Codes:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Wind Codes</th> <th style="text-align: left;">Hearthquake Codes</th> </tr> </thead> <tbody> <tr> <td>ANSI</td> <td>ANSI 1982</td> </tr> <tr> <td>ASCE 7-95</td> <td>ASCE 7-95</td> </tr> <tr> <td>CNR 1982</td> <td>CNR 1986</td> </tr> <tr> <td>CNR 1996</td> <td></td> </tr> <tr> <td>NEIGE ET VENT</td> <td>PARASISMIQUE PS92</td> </tr> <tr> <td>BSI CP 3</td> <td>UBC 1988</td> </tr> <tr> <td>UBC 1994</td> <td>UBC 1994</td> </tr> <tr> <td>UBC 1997</td> <td>UBC 1997</td> </tr> </tbody> </table> <p>The resultant Force and Moment are applied to supports for allowing the Stability Check and the calculation of loads acting on foundations.</p>	Wind Codes	Hearthquake Codes	ANSI	ANSI 1982	ASCE 7-95	ASCE 7-95	CNR 1982	CNR 1986	CNR 1996		NEIGE ET VENT	PARASISMIQUE PS92	BSI CP 3	UBC 1988	UBC 1994	UBC 1994	UBC 1997	UBC 1997
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•	<p>Supports positioning and stability check.</p> <ul style="list-style-type: none"> • Saddles The check is carried out according to Zick method • Brackets The check is carried out according to Bijlaard/BS5500 method
•	<p>Tubes to Tebesheet Welding Analysis according to ASME VIII Div. 1 Para UW20.</p>
•	<p>Check of tubes of the bundle according to the design Codes. For U tubes also the analysis relevant per TEMA RCB-2.31 e ASTM A556 can be performed.</p>

OUTPUTS	
	The results of exchanger calculation consists of a tabular report, Exchanger Drawings, Bill of Materials and the Audit Reports Book.
ASCII Report	All relevant data of the exchanger are printed out, including the results of numerical calculation and geometrical dimensioning.
Bill of Materials	All components belonging to the exchanger under design are summarized in a table with dimensions, weights and number of items. The table can be viewed on screen, printed or exported as Excel file for further processing (Cost Estimates).
Drawings	<p>Drawings are automatically generated by MT-EXCH in three A3 sheets (a fourth sheet is added when cladding is provided on one or more components).</p> <p>Details on each sheet are as follows:</p>
•	<p>1st Sheet - Tables related to:</p> <ul style="list-style-type: none"> • Design data • Tube bundle data • Weights and Loads • Nozzles (Radial, Offset, Inclined) welding analysis included • General Notes • Reference Standards • Revisions

	<ul style="list-style-type: none"> • Materials
•	<p>2nd Sheet - Setting Plan and Nozzles Positioning. The drawing is scaled in order to show the relative dimensions of the exchanger. The nozzles, also scaled and including reinforcing pad, if any, are shown both in longitudinal and circumferential views. Details for saddles base plate, both fixed and sliding, are shown on the same drawing for horizontal exchangers.</p>
•	<p>3rd Sheet - Constructive drawing and baffles positioning. All the exchangers components are drawn with quotas and dimensions.</p>
	<p>Drawings can be generated in English or Italian language (other languages using Latin alphabet can be easily provided) and it is possible to choice between the following system of units:</p> <ul style="list-style-type: none"> • Metric • English • International Standard (S.I.) • User Defined <p>Drawings are produced in DXF format for easy importing them in AUTOCAD, or in many other CAD programs which accept this very popular standard, for further enhancements.</p>
Audit Reports Book	<p>For all the exchanger components datasheets including formulas and substitutions are shown on the screen and can be printed or saved on a file. The user can complement the data sheets automatically printed by the program with:</p> <ul style="list-style-type: none"> • Cover Pages. The included Page Editor, also if simple, allows for an exhaustive text handling and for the insertion of file images in BMP, WMF, JPG formats. • Index of Contents. The program, if so requested, automatically produces an index with pages numbering referred to every component. <p>Datasheets can be produced in English or Italian languages, selecting S.I. or English system of measurement units.</p>

IMPORTING THERMAL RATING DATA

The MT-EXCH program allows the automatic importing of data coming from the thermal rating of the exchanger through two different kinds of tools:

- **Direct Interface**
- **Neutral File**

Direct Interface

This is an interface developed by Micro Techno for directly addressing the outputs of a specific program.

The interfaces actually available are:

- **Files *.dbo:** Output Files of the H.T.R.I. Xist program for the thermal dimensioning of Shell&Tubes Heat Exchangers (**HEAT TRANSFER RESEARCH Inc.** - Houston, TX - U.S.A.)

Neutral File

The MT-EXCH program allows the automatic importing of data coming from the thermal rating of the exchanger, provided that such data are organized in a Neutral File (ASCII format). The file has to be generated by an external program before to start the MT-EXCH program.

The Neutral File Format is freely available !!!

MICRO TECHNO ENCOURAGES THERMAL RATING SOFTWARE DEVELOPERS TO INCLUDE THIS INTERFACE IN THEIR PACKAGES

One of the programs that already allows for this kind of interface is the **CC-THERM** program by **Chemstations Inc.** (Houston, TX).

OTHER INTERFACES

The MT-EXCH program can read directly from the MT-LAYOUT files data related to the tubes of the bundle and OTL (Outside Tubes Limit) without the need for manually reinputting these data.