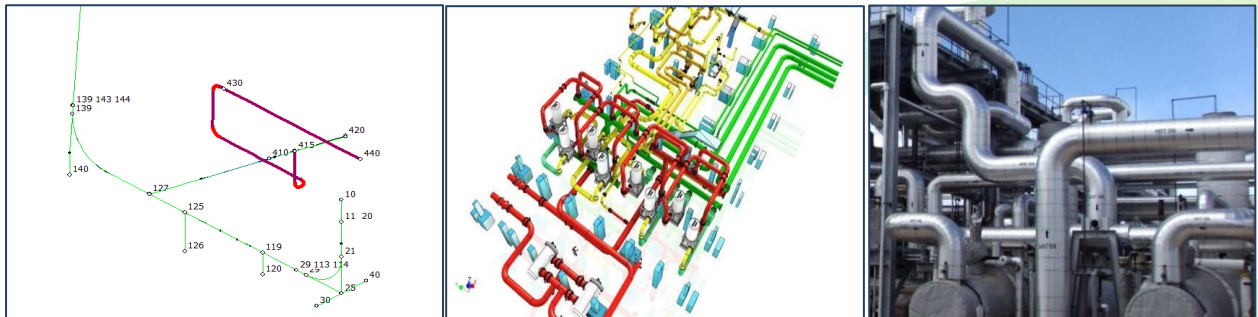


P₁₀

PIPE STRESS ANALYSES



'P₁₀ is a software program for analysing your pipe system'

P₁₀ Pipe-stress-analysis software

Aims

P₁₀ Pipe stress analysis software has been developed to calculate stress in piping systems. It is used extensively in Chemical, Oil & Gas, Energy and Nuclear Plant Design. It has proven to be very useful, in particular for the calculation of stresses in tubular pipe systems.

P₁₀ software is constantly tailored to the latest insights. It represents an experience of over 40 years in pipe stress analysis. The experience is gained not only by developing the software, but by stress-engineering as well.

P₁₀ software features

Besides the general features for pipe stress analysis, **P₁₀** software offers features to:

- ✦ enter nodal restraints with respect to the local co-ordinate system
- ✦ take into account expansion joints and non-tubular elements
- ✦ handle pipe systems with non-linear boundary conditions like friction and limit stops
- ✦ evaluate non-linear boundary conditions through a fast iteration process, based on an advanced solution method
- ✦ handle several load cases within one calculation
- ✦ distinguish the load components of a load case, such as:
 - ▶ weight
 - ▶ cold spring (pull/push)
 - ▶ internal pressure (including correction for the increasing height)
 - ▶ thermal expansion
 - ▶ wind (including projection)
 - ▶ earthquake loading (acceleration)
- ✦ define prescribed nodal displacements and concentrated loads for the different load components
- ✦ take into account the effects of rerounding and "Bourdon"
- ✦ enable the definition of a load case as any combination of load components
- ✦ design spring hangers (including prestressing, range, and safety tolerance), based on spring tables provided by manufacturers
- ✦ read pipe profile and material data directly from a separate database, which can be manipulated by the user,
- ✦ calculate stresses according to all current Design Codes, such as:
 - ▶ D1101 (Dutch)
 - ▶ ANSI B31.1 & B31.3 (American)
 - ▶ DIN 2413 (German)
 - ▶ BS 806 (British)
 - ▶ CODETI (French)
 - ▶ Eurocode EN-13480 (European)
- ✦ adapt the software to calculate stresses according to user specific rules
- ✦ determine the allowable stresses based on the material database, and perform the code checking of the stresses
- ✦ calculate ideal stresses according to Coulomb or Huber-Hencky
- ✦ determine the extreme ideal stress in both the axial direction of the element and along the circumference of the cross section

Input facilities

P₁₀ software aims at reducing and simplifying the input of data. Features are available to:

- ✦ *use pipe data numbers to define cross-sectional data of elements*
- ✦ *use load data numbers to define the material and load data of the elements*
- ✦ *generate parts of the pipe-system by copying identical parts (including translation, rotation, and renumbering)*
- ✦ *use default values where appropriate*
- ✦ *enable free numbering of nodes and elements*
- ✦ *processes closed loops automatically*
- ✦ *enable input both by a Windows User Interface (including online documentation and job control facilities) and a powerful keyboard-oriented free format input language*
- ✦ *change input data, and display input values and results through an interactive Windows based processor including online help features*

Output facilities

P₁₀ software aims at correct interpretation by improving the readability of the results. Features are available to:

- ✦ *add explanatory text where useful*
- ✦ *include clear headings and units in all tables*
- ✦ *offer alternative output types to be selected by the user*
- ✦ *make bar graphs of stresses in elements of the pipe-system*
- ✦ *make review tables with the results of several cases*
- ✦ *generate summary tables with extreme stresses, stress ratio and displacements*
- ✦ *generate a tables of contents (incl. page numbers)*
- ✦ *modify the presentation to be plotted, through possibilities to:*
 - ▶ *select parts of the pipe system, based on node numbers or co-ordinates*
 - ▶ *assign a point of view*
 - ▶ *adjust to scale automatically*
- ✦ *plot or print the input and results, such as:*
 - ▶ *geometry (including node, element, profile, and load numbers)*
 - ▶ *displacements*
 - ▶ *a combination of geometry and displacements in different colours*
 - ▶ *the stress ratio and other stresses*
 - ▶ *including selective printing or plotting*

Interfaces

P₁₀ software supports interfaces to a number of analysis software.

Options

W15, software plug in for the calculation of nozzles according to WRC 107 or WRC 297.

GRE, Software plug in module for the calculation of Glass-fibre Reinforced (Epoxy) materials.

Summary facilities *P*₁₀ PC-version

Software limits

Elements (members): 3000
 Restraints: unlimited

Hardware requirements

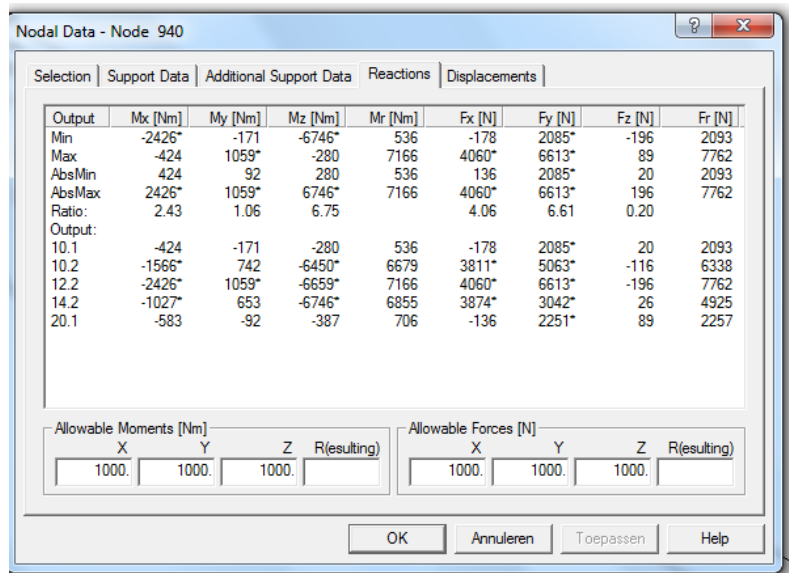
Processor: MS-Windows PC
 Operating system: Windows 95 / 98 / NT / 2000 / XP / Vista / 7 / 8
 CAD-interface: DXF, Alias ISOGEN PCF

Approval by Lloyds Register (Dutch notified body)

The results of *P*₁₀ software are accepted by "Lloyds Register" (Dutch notified body) for the assessment of piping systems.

Language

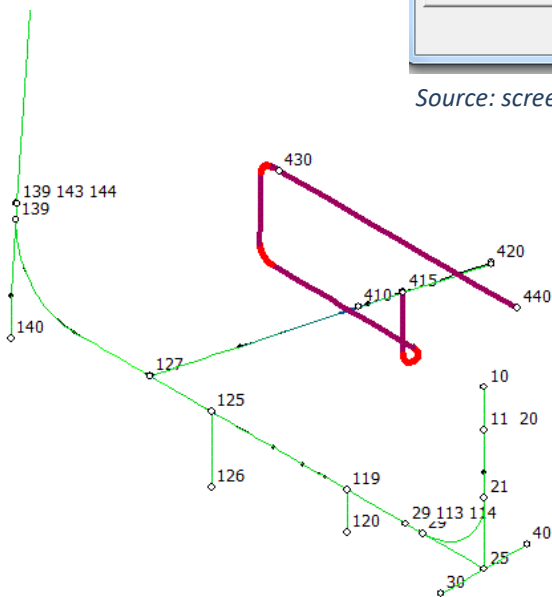
English.



Output	Mx [Nm]	My [Nm]	Mz [Nm]	Mr [Nm]	Fx [N]	Fy [N]	Fz [N]	Fr [N]
Min	-2426*	-171	-6746*	536	-178	2085*	-196	2093
Max	-424	1059*	-280	7166	4060*	6613*	89	7762
AbsMin	424	92	280	536	136	2085*	20	2093
AbsMax	2426*	1059*	6746*	7166	4060*	6613*	196	7762
Ratio:	2.43	1.06	6.75		4.06	6.61	0.20	
Output:								
10.1	-424	-171	-280	536	-178	2085*	20	2093
10.2	-1566*	742	-6450*	6679	3811*	5063*	-116	6338
12.2	-2426*	1059*	-6659*	7166	4060*	6613*	-196	7762
14.2	-1027*	653	-6746*	6855	3874*	3042*	26	4925
20.1	-583	-92	-387	706	-136	2251*	89	2257

Allowable Moments [Nm]				Allowable Forces [N]			
X	Y	Z	R(resulting)	X	Y	Z	R(resulting)
1000.	1000.	1000.		1000.	1000.	1000.	

Source: screenshot of the *P*₁₀ window, data output



Source: screenshot of the *P*₁₀ window, isometric view of the piping system

Conditions for the sale of **P₁₀** software

Sale

By sale is meant the sale of the right to use the software. Please contact us for the exact price.

Maintenance and support

Maintenance and support include:

- ✦ support through our help-desk,
- ✦ software updates,
- ✦ price reductions for extensions, new revisions and/or new software modules.

The annual maintenance fee is a percentage of the price of the software. Please contact us for the exact annual maintenance fee.

Additional licences

Additional licences can be purchased with a substantial discount on both the price and the annual maintenance fee:

- ✦ second licence: 40%,
- ✦ subsequent licences: 60%.

Guarantee

Guarantee is provided for a period of three (3) months.

Installation

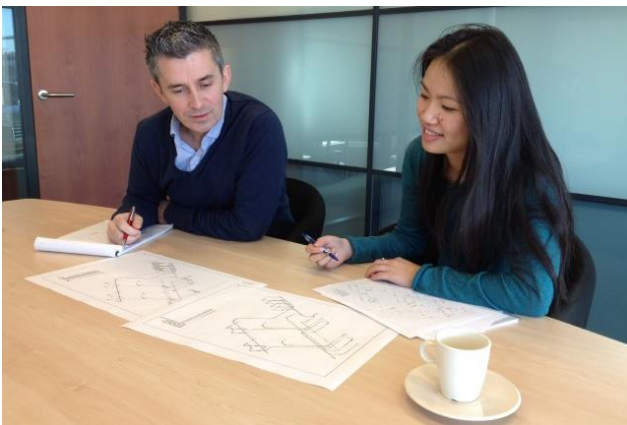
Array Industries offers support during installation of **P₁₀** software on your system.

Training

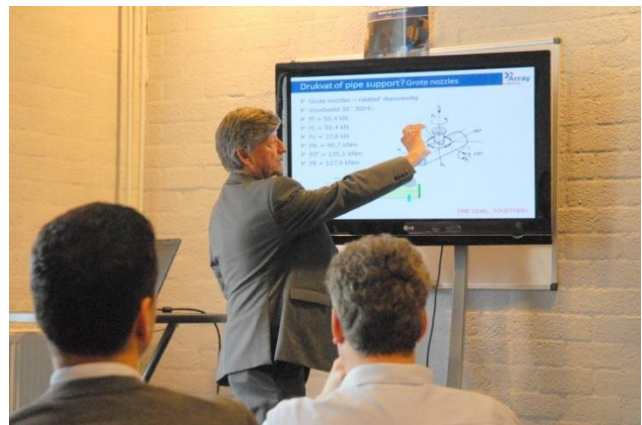
In addition, Array Industries offers training for efficient use of **P₁₀** software by your employees.

Manual

An extensive user manual is available for **P₁₀** software users. This manual is online available from within the help function of the Windows User Interface. A pdf version is available for printing.



P₁₀ pipe stress engineering by Array Industries



P₁₀ pipe stress training



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YOUR EMISSIONS IN CONTROL