



# ROHR2

Program System for Static and Dynamic Analysis of  
Complex Piping and Skeletal Structures

## ROHR2 Update 32.1 October 2017 New Features and Improvements

The program system ROHR2 with its additional modules is checked and modified continuously within the scope of the maintenance agreement.

The program release ROHR2 32.1 replaces the ROHR2 32.0, October 2015:

This document shows the improvements and enhancements of the program release ROHR2 32.1.

### Overview

- Miter bends:  
Miter bends can be defined and displayed separately. In case of a defined segment spacing the radius can be determined, alternatively a radius can be defined manually.
- Enhanced documentation of bedding results
- FW 401: detailed stress analysis for bend and tee
- Alternative analysis of bends and tees acc. to FW401 which is less conservative
- Internal pressure analysis:  
Interactive internal pressure analysis available at each component
- Colored representation of the internal pressure analysis results
- Layer controlled graphical objects:  
Layer controlled objects like groups of text can be hidden /shown.
- Definition of ranges for documentation purposes and easier assignment of data
- ROHR2fesu: available substructures can be extended
- ROHR2fun has been totally revised.
- Databases updated
- AUTODESK PLANT3D Plugin

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## ROHR2 32.1, Changes and Improvements, detailed

### Updated Stress Codes

Title	Content, keywords and source	Edition
ASME B31.4	Liquid Transportation Systems Piping ASME Code for Pressure Piping The American Society of Mechanical Engineers, New York	2016
ASME B31.5	Refrigeration Piping ASME Code for Pressure Piping The American Society of Mechanical Engineers, New York	2016
VGLSP	Stress Analyses for Skeletal steel structures (VGLSP)	2010
ASME CL1 2)	NB-3600 "PIPING DESIGN" in ASME-BOILER AND PRESSURE VESSEL CODE SECTION III SUBSECTION NB CLASS 1	2017
ASME CL2 2)	NC-3600 "PIPING DESIGN" in ASME-BOILER AND PRESSURE VESSEL CODE SECTION III SUBSECTION NC CLASS 2	2017
ASME CL3 2)	NC-3600 "PIPING DESIGN" in ASME-BOILER AND PRESSURE VESSEL CODE SECTION III SUBSECTION ND CLASS 3	2017
<b>ROHR2press</b>		
TRFL	Technische Regel für Rohrfernleitungen nach § 9 Absatz 5 der Rohrfernleitungsverordnung vom 8. März 2010  <i>District Heat Piping standard in accordance with § 9 Absatz 5 der Rohrfernleitungsverordnung/German Law</i>	2010
<b>ROHR2fesu</b>		
EN 13445-3	Stress Analysis of FESU structures acc. to EN 13445-3 Appendix C	2016
AD 2000 S4	Stress Analysis of FESU structures acc. to AD 2000- S4	2016

### Settings

- When running projects from net drives a local temporary working directory can be selected. This is used to accelerate the calculation.  
In this case the program copies the project data automatically into a temporary directory in the local user directory when opening the project file. All processes and calculation runs are carried out in the original net drive. If the project is closed the project data including result files will be copied back to the net drive.



## **Modelling**

- Instruments:  
At rigid elements like instruments, etc now a circular profile is defined at the place of a pipe definition to avoid misleading messages regarding extended wall thickness in stress analyses. Please note, there is no more stress analysis carried out at those components.
- Flanges:  
At flanges a specified wall thickness and a special material can be entered. In the calculation model the wall thickness of the connecting flange is used.
- Bends:  
At bends now analogues to the treatment of reducers and tees the data can be taken from a norm/pipe class.
- Miter bends.  
Miter bends can be defined and displayed separately. In case of a defined segment spacing the radius can be determined, alternatively a radius can be defined manually.
- Detailed i-factors can be inserted at nodes which are used at the place of the i-factors of the component name
- Reducers, tees:  
The selection between several components now is possible when choosing a pipe class ( e.g. concentric and eccentric reducers). Selection using the parameter „Type“.
- Expansion joints:  
At user defined expansion joints a temperature reduction can be inserted possible (reduction factor table can be selected)
- The number of bellows (1 or 2) can be entered at user defined axial expansion joints. It is possible to determine missing parameters Ca und Cl automatically.
- Visco dampers:  
In harmonic excitation load case the excitation frequency can be used for the determination of the equivalent stiffness.

## **Soil restraint**

- Expansion cushions:  
The stiffness values at the connection of areas with or without cushions and various cushion thicknesses have been revised. The transition will be interpolated in a certain range to avoid extreme rigidity differences before and after the node.
- PU foam:  
Parameters for tension and pressure (for stiffness /stresses) now are part of the calculation
- Documentation of the bedding results:  
Now including:
  - Output of the equivalent bedding coefficient
  - Graphical representation of the results in bedding curves
  - Graphical representation of the results curve in one segment



## **Loads**

- **Assembly temperature:**  
A particular assembly temperature can be defined at segments e.g. to consider thermal pre-stressing.
- **Line loads:**  
New load category "Line mass" for the definition of load case depending additional line masses to be added to the line masses of ROHR2/profiles.
- **Calculation data:**  
In the dialog Pipe dimensions the maximal operation data can be used as calculation data automatically (standard setting with new piping models) In this case the extreme operation data at each segment.
- **Setting:**  
The setting (soil restraint) now can be inserted with any coordinate system and can have a trapezoid shape like some other line masses.
- **Wind loads:**  
The automatic determination of the wind load can be completed by the parameter ice thickness. The plane, relevant for the determination of the wind load will be increased by the given ice thickness.

## **Spring design- / constant hanger design**

- Minimum travel range at constant hangers/ supports and spring hangers/ supports

## **Stress analysis**

- **FW 401:**  
detailed stress analysis for bends and tees
- **EN 13941**  
Alternative analysis of bends and tees acc. to FW401 which is less conservative
- **ISO 14692 (GRP)**  
A „biaxial stress relation  $r$ “ which depends on material definition and settings and a „qualified stress“ factor can be inserted at the nodes at each section in stress analyses acc. to ISO 14692 (GRP)
- **Tees:**  
„Biaxial stress relation  $r$ “  
is for tees 1.0 and for bends 0.45 now, independent of the material definition, see table 4, 7.11.4 in ISO 14692. At bends the definition can be modified at the settings of the stress analyses (1 and-1.9, see table 4).



## Calculation

- Internal pressure analyses:  
Internal pressure analyses: now available at each component
- Warning message at non conservative calculation data:  
The warnings in case of non conservative calculation data have been revised. In temperature case the allowable stress is checked if one either the calculation temperature or operation temp. is < environment temperature and additionally another temperature is > than the environment temperature
- Checking the material coefficients in low temperature ranges:  
In low temperature ranges the availability of AlfaT and Ny analogue to the Youngs modulus is checked. The user is asked to complete the data.

## Results representation and documentation

- Color representation of the internal pressure analysis
- In the segment dialog the operation data lists additionally the Youngs modulus and expansions:
- In the results dialog at the node there is an additional option to show the output table of a particular extreme value calculation at the node. If entered the extreme value calculation will be carried out for this node automatically.
- Layer controlled graphical objects:  
Layer controlled objects like groups of text can be hidden /shown.
- Expansion joints list:  
The list shows allowable movements of expansion joints.
- Report: the report now includes a new table for single masses.
- Texts in the graphic: Names of tees, expansion joints and single masses can be shown as text blocks.
- Regions definition:  
Select any partial system to define and name it as a "region". Segments can be part of several regions.  
Regions can be shown and selected by the function *Segment parameters*
- An additional name and instruction can be added to operation data.
- The project information can be part of the output file of tasks at the beginning of a comment.
- Selected parameter lists can be copied by Ctrl+C into the clipboard, in text format, csv format or rtf to be used as a table in applications like Excel or Word (Excel: CSV format, Word, RTF format).
- The sheet size has been added by the option Determine automatically (menu Project settings | Graphics), default setting in ROHR2 32.1. The sheet size automatically is adapted to the model size including an optimized scaling of the text sizes for printing.

Sheet size

Determine automatically     A0     A1     A2     A3     A4

The sheet size definition of former ROHR2 models will remain.



## **ROHR2fesu**

- Load case type „ Separately acting loads“  
In ROHR2fesu the parameter GRWE can be selected as operator for single load directions. In the automatic ROHR2fesu stress analysis the generation of maximum values using this loads in substructures is possible.
- Changes in EN 13445 implemented: stress analysis possible at components in creep range.
- Operation data inside a substructure:  
Operation data in a substructure now can be assigned by each super element. This can be used to calculate a substructure in a load case e.g. with different temperatures (supports in bends, jacket pipe).
- Material transition inside a substructure:  
Stresses resulting from temperature now are considered at the connection of two materials if a substructure consists of different materials with significantly varying temperature expansions.
- Extending available substructures:  
Existing substructures now can be extended by selecting pipe segments where the substructures are assigned to.

## **ROHR2fun**

- ROHR2fun totally revised.

## **ROHR2press**

- The life cycle and additional parameters can be part of the analysis if the calculation standard is defined.

## **Interfaces**

- AUTODESK PLANT3D Plugin  
The ROHR2- Plant3D Plugin, developed by SIGMA, enables to generate the data necessary for the ROHR2 stress calculation in the Autodesk Plant3D design process.  
The plugin is used to convert data from P3D attributes in a format, readable by the optional available ROHR2 CAD interface package.
- PCF-Interface:  
Each component can be equipped with a unique reference. The attribute containing the reference is to be defined by „Att\_RefID“ in the pcf.env file.  
This is used to refresh a ROHR2 model, originally created by a PCF file by means of a new PCF file.

## **Software Development, Sales and Support**

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## ROHR2 32.1, Manual modifications

List of changes and modifications in ROHR2 32.1 manuals

Chapter	Title	Type of modification	Details
<b>ROHR2install</b>			
3.2	Single user license installation	completed	Driver
<b>ROHR2install</b>			
2.1	Program and data carrier	revised	
3	Activating the program license	revised	
4	Actualization of program licenses	revised	
4.1	Actualization - General	corrected	HLSCAN path changed
4.2.2	Update license key	revised	
4.2.3	HLSCAN.EXE processing	corrected	HLSCAN path changed
<b>ROHR2tutorial</b>			
	ROHR2 32.0 Tutorial		completely revised 16.01
1.1	ROHR2 test license (full featured)	revised	
<b>ROHR2win</b>			
1.1	Program name and installation	revised	
1.3	References and links	completed	
2.11	Program documentation	completed	Help files - Internet
2.11.1	User manuals	completed	Access help files via Internet
2.2	Language of the user interface	revised	
2.3	ROHR2win User Interface - Overview	revised	
2.4.1.4.1	Dialog window Display	revised	
2.8.2	Right mouse button	revised	
2.11.1	User manuals	revised	
3.1.1	Interface Overview	revised	links to manuals, E3D, PLANT3D, FLOWNEX
3.1.2.1			
3.1.2.2	File formats - Overview	extended	E3D, Fluid hammer forces
3.1.2.6	CSV interface- import of geometry data from text files	corrected	
3.1.2.7	AVEVA PDMS/E3D - ROHR2 data import	extended	E3D
3.1.2.18	Import of load -time-functions	new	
3.1.2.19	PLANT3D data	new	
3.1.3.1	Export filters	corrected	PIPENET export
3.1.3.9	PDMS/E3D - ROHR2 data export	extended	E3D
xx3.1.3.13	PIPENET Data export	removed	



3.1.3.13	Interface for exchange of data between ROHR2 and CFD software	new	
3.2	Additional ROHR2 modules	revised	ROHR2stoss removed
4.1.2	Open	completed	Description *.er2 , c2v, PLANT3D
4.1.11	Export	completed	
4.1.11.1	Export-clipboard - General view	completed	factor
4.1.11.8	Export Results to PDMS	extended	E3D
4.4.12	Nozzle analysis with ROHR2nozzle	corrected	
xx4.2.7	Pipe classes	removed	replaced by "Load pipe class dimensions"
xx4.2.7.1	Import pipe classes	removed	see "Import pipe classes" below
4.2.7.1	Dimensions dialog window	extended	save, load, internal pressure
4.2.7.1.3	Load pipe class dimensions	revised	
4.2.7.1.4	Import pipe classes	removed	
4.2.8.2	Pipe dimensions - Register Pipe	completed	calculation data , internal pressure analysis
4.2.8.2.1	Pipe, straight	completed	internal pressure analysis
4.2.8.2.2	Bend	completed	internal pressure analysis
4.2.8.3	Change type of structural section	removed	
4.2.8.3	Define structural section	revised	
4.2.8.4	Define any structural section	removed	
4.2.9.2	Define dimensions of structural sections	revised	completely
4.2.9.3	Change type of structural section	new	
4.2.9.4	Define standard structural section	new	
4.2.9.5	Define any structural section	new	
4.2.13	Assign special assembly temperature	new	assembly temperature
4.2.15	Regions	new	define regions
4.2.15.1	Edit region	new	
4.2.18	Select	extended	substructure
4.2.18.5	Select - regions	new	
4.2.18.8	Select - Superlements of a substructure	new	
4.2.18.9	Select - Jackets of a substructure	new	
4.2.20.22	Visco damper	revised	
4.2.22.3.4	Soil data EN 13941	revised	elastic displacement, reduction factor kappa , pipe flexibility
4.2.22.3.5	Soil data AGFW FW 401	revised	elastic displacement, reduction factor kappa , pipe flexibility
4.2.24.3	Bend	revised	completely
4.2.24.4	Flange	revised	completely
4.2.24.6	Inserting reducers at nodes with changes in dimensions	revised	
4.2.24.9	Tee	revised completed,	
4.2.24.10	Instrument	corrected	calculation model
4.2.24.14	Lateral expansion joint	revised	stiffness
4.2.24.15	Angular expansion joint	revised	stiffness
4.2.24.16	Axial expansion joint	revised	bellows, stiffness



4.2.25.4	Extend substructures	new	
4.2.26	Insert text, graphics	completed	text groups
4.2.26.2	Text groups	new	
4.2.26.2.1	Group	new	
4.2.26.2.2	Edit text group	new revised,	
4.3.2.1	Register nodes	completed	i-/ BCK factors, FR Pipes
4.3.2.3	FRP stress analysis	new revised,	
4.3.2.4	i-Factors /BCK-factors	completed	enhanced input of factors
4.3.3.1	Register Segment	extended	assembly temperature
4.3.3.2	Register Operation data	extended	Young's modulus detailed
4.3.3.6	Register FE substructure	extended	
4.3.5	List data	completed	delete function
4.4.9.1	Spring design - settings	extended	travel range
4.4.16.1.1	Edit operation data	extended	description
4.4.19.1	Edit Wind load	extended	wind velocity, ice thickness
4.4.22	Line loads	completed	mass, load categories
4.4.22.1	Edit line load	extended	load type line load, constand load
4.4.23.1	Edit settlement	revised	completely
4.1.1.1	Results at nodes	completed	extreme values
4.5.1.1.5	Extreme values node nn	new	
4.5.1.2	Showing results at segments	completed	
4.5.1.2.1	Soil restraint results at segments	new	
4.7.5	Text groups	new	
	Display settings	new	
4.9.1.1	Register General	completed	Help, Local working directory
4.9.3.5	Project Printing settings	completed	
4.12.1	Contents	completed	Help files - Internet
4.12.5	Manuals	completed	Help files - Internet
4.12.6.2	Updates without internet connection	completed	Update proccess usingy Smartfeed
4.12.7.1	Update license key	revised	HLSCAN path changed
4.12.8	Info	completed	Licensing, LIC ID
4.12.6.2	Updates without internet connection	completed	ROHR2 forum, updates provided for download
	XXX	XXX	
<b>ROHR2basic</b>			
	Part 1 - static		
1	Preliminaries	revised	help files
10.9.14.1	HR, HRK	correction	units removed
11.1.5	Internal pressure	correction	equations formatting
15.1.4	Input records in .SIP - Overview	completed	description of super elements
15.3.12	USTE	completed	



15.3.13	REKO (Rectangular duct, conical)	new	
15.3.14	URER (Duct transition rectangular - circular)	new	
22	Internal pressure analysis (pipe, bend, tee)	removed	replaced by the program module ROHR2press
23.1.2	Determination of the characteristic curves according to EN 13941:2009	new	
23.1.2	Determination of the characteristic curves according to AGFW 09/2000	replaced	by AGFW FW401 12/2007
23.1.3	Determination of the characteristic curves according to AGFW FW401 12/2007	new	
23.2.1.5	Transition at expansion pads with different thicknesses	new	
23.3.1	Allowable stresses	revised	manual input
23.3.3.7	Tension and pressure stress SIG-D in the PU-foam	revised	completely
23.4.2	Documentation of the bedding model	extended	
32.2	Static fluid hammer loads - Calculation	correction	Parameter TR --> TS
62.4	Table: MATDAT materials	correction	table American materials, SA269TP316 removed
82.4.6	Extreme Displacements	correction	graphic
	Part 2 - dynamic		
72.3	RRH (Controlling harmonic excitation)	correction	GFREQ
	Part 3 - documentation		
82.3.2.1	Protection against elastic buckling	correction	headline

#### ROHR2stress HB

1.1	Stress analysis rules - Overview	correction	Revision ASME B31.3, B31.4, B31.5, VGLSP, ASME Cl. 2, Cl3, TRFL
11.1	Calculation basics EN 13480	revised	
11.1.1	Longitudinal stress due to sustained loads	revised	
11.1.2	Longitudinal stress due to sustained loads (load case pressure test)	revised	
11.1.3	Longitudinal stress due to sustained and occasional loads	revised	
11.1.4	Stress range due to thermal expansion and alternating loads	revised	
11.1.5	Additional conditions for the creep range	revised	
11.1.6	Stresses due to single non-repeated support movement	revised	
14.1.7	ROHR2 names of components according to AGFW FW401	corrected	equation TTU
32.2.1	ASME B31.3 Longitudinal stresses due to sustained and occasional loads	corrected	Param Fa
53	TRFL	new	District heat piping, coming soon

#### ROHR2fes u

1.3.2.3	Limitations of the intersection area	completed	figure
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### ROHR2flange

manual completely revised

### ROHR2fun

manual completely revised

### ROHR2nozzle

1.2.2	Standard	extended	list of standards extended
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### Interfaces

SDNF manual initially new

#### 01.01 Neutral Interface

5.3.6	NOZZLE: Nozzle	new	
5.4.2	PMASS: Point mass	new	
5.4.3	IF: internal spring	new	

#### 02.01 - PCF Interface

4.1	Available types of data	completed	reference
5	Export of data in PCF format (ROHR2)	completed	R2_REF
6.2.3	Attributes - Assignment of attributes to data types	completed	reference

#### 03.04\_CFD fluid dynamics Import Export

new manual

#### 04.06\_Export\_ROHR2-PLANT3D

new manual

#### Neutral Interface

Extras		correction	Extras replaced by Loads/ Tasks
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