



# Líneas de Proceso y Fuerza. Incrementa la productividad y ahorre 50% de tiempo con PASS/START-PROF 4.84

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Líder de product START-PRO



PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

# PASS/START-PROF

Análisis inteligente de esfuerzos en tuberías  
así como un dimensionamiento óptimo

Presentador:

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# Agenda del webminar – Parte 1

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- Rápida introducción a PASS/START-PROF
- Códigos Incluidos para líneas de proceso y fuerza
- Capacidades de integración
- Principio de creación de modelado de tubería orientada a objetos
- Tipos de objetos: tuberías, tees, codos, reducciones, etc.
- Objetos Equipo: Boquilla, Boquilla en tanque, Bombas, Bombas verticals en línea, Turbina, Compresor, Aeroenfriador, a fuego directo
- Objetos junta de expansión
- Bases de datos, ASME B31J, Creep self-springing effect, viento, hielo, nieve, cargas sísmicas



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# Agenda del webminar – Parte 2

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- Mínima Temperatura de diseño del metal (MDMT) de acuerdo con 323.2.2 (a)-(j) ASME B31.3
- Esfuerzo permisible ocasional alternativo de acuerdo con 302.3.6 ASME B31.3
- Factor de uso por fatiga, de acuerdo con el Apéndice V ASME B31.3
- Análisis para sistemas con material FRP/GRP/GRE
- Cálculo de espesor de pared para los accesorios y la tubería/cañería
- Editor de modo de operación. Casos de carga
- Reportes: esfuerzos en la tubería/cañería, en aislamiento, por sismo, por fallas, cargas en las restricciones, en equipos, desplazamientos, verificación en junta de expansión, selección del resorte variable, resorte constante, análisis por deformación, fugas en bridas
- Características especiales



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Análisis completo de esfuerzos en tuberías, flexibilidad, estabilidad y análisis por fatiga con cálculos de dimensionamiento

## Rápido análisis de esfuerzos en tuberías así como un dimensionamiento óptimo

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- Amplia aplicación
- Aplicación insuperable
- Capacidades poderosas
- Base de datos extensa
- Configuraciones flexibles
- Amplio Soporte a códigos
- Utilizado ampliamente



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# PASS/Start-Prof | Amplia Aplicación

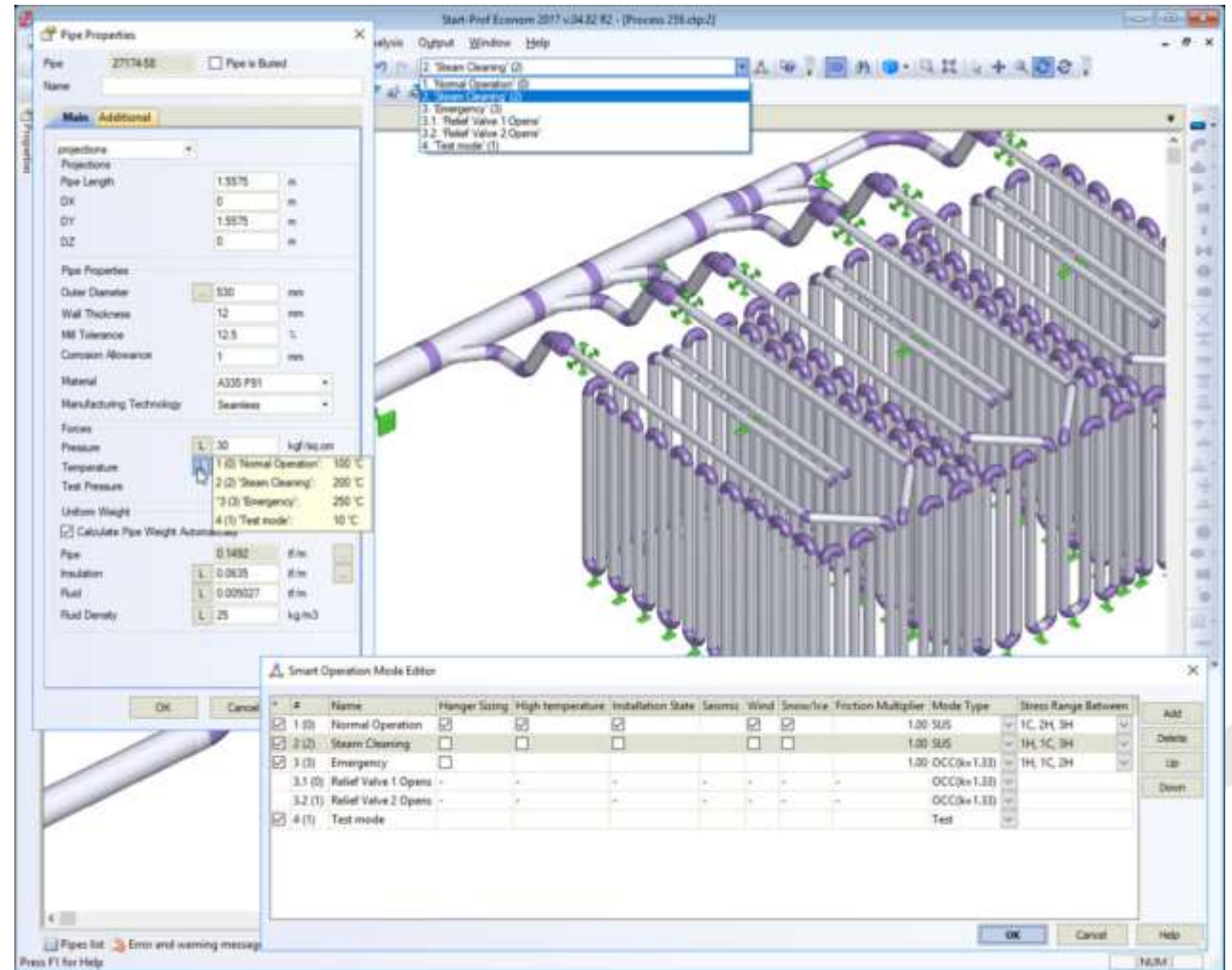
- Tubería para la industria de proceso
- Oleoductos y gasoductos
- Tuberías para redes de servicios públicos
  - Redes de calefacción
  - Gas Natural
  - Agua
- Líneas en plantas de Fuerza



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# PASS/Start-Prof | Características

- PASS/START-PROF para análisis de líneas de Proceso y Fuerza
- Incremente productividad y ahorre tiempo
- Ahorre dinero (temenos políticas amistosas de precios)
- Incremente la exactitud en los análisis de esfuerzos



# PASS/Start-Prof | Aplicación amplia

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- Desarrollado desde 1965
- 2000+ usuarios activos (compañías). 8000+ Licencias
- Interfaz del Usuario y documentación en idiomas: Inglés, Chino, Ruso
- Códigos de tuberías: 32
- Códigos de Viento, Sismo, Nieve, Hielo: 18

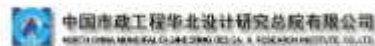


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# PASS/Start-Prof | Nuestros clientes



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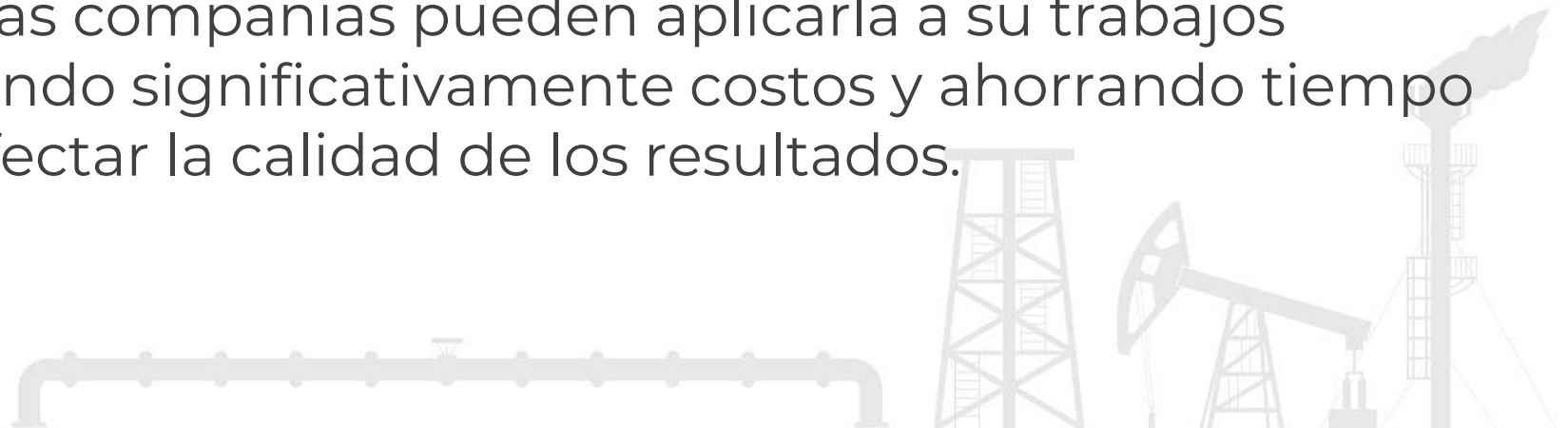
# PASS/Start-Prof | Características

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- Respuesta inmediata por ingenieros con experiencia en Reino Unido, China, México, Brasil, Australia, Egipto, Turquía y otros
- Disponible soporte por los desarrolladores vía e-mail
- Fácil de aprender, rápido y sencillo de trabajar para los nuevos analistas de esfuerzos en la tubería.
- Puede trabajar de inmediato gracias a la intuitiva interfaz con el usuario orientada a objetos. Las compañías pueden aplicarla a su trabajos rápidamente, reduciendo significativamente costos y ahorrando tiempo de capacitación sin afectar la calidad de los resultados.



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# PASS/Start-Prof | Características

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## PASS/START-PROF es una parte de la suite PASS:

- **PASS/START-PROF** – Software para análisis de esfuerzos en tuberías
- **PASS/HYDROSYSTEM** – Software para análisis hidráulico y térmico en la tubería
- **PASS/ NOZZLE-FEM** – Software para análisis por método de elemento finito para uniones de Boquillas al cuerpo principal. Calcula SIF, factores de flexibilidad, Analiza Flexibilidad y esfuerzos en Boquillas, etc.
- **PASS/EQUIP** – Software para diseño de recipientes a presión, Columnas, Intercambiadores de calor, software para diseño y análisis de tanques.



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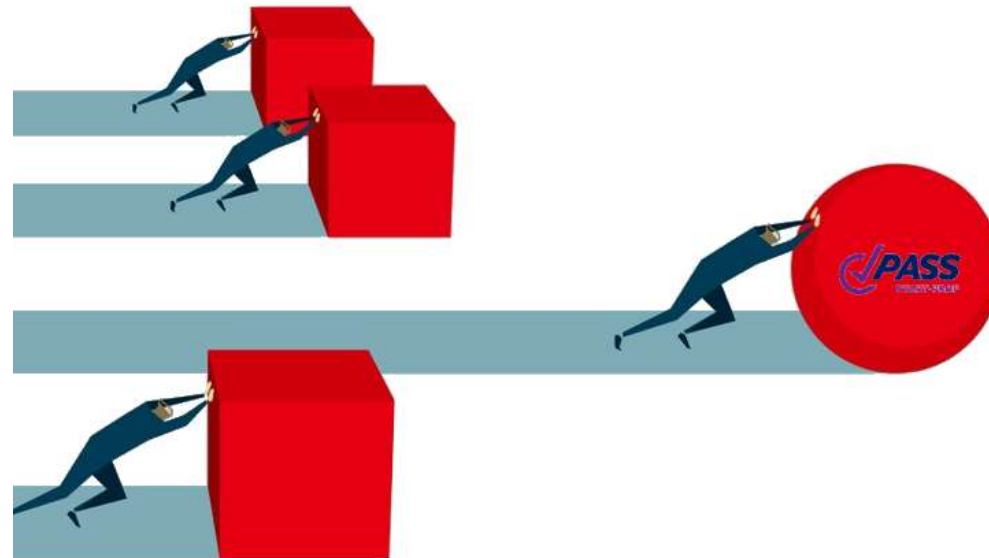


# PASS/Start-Prof | Incremento de productividad

PASS/START-PROF es un software moderno para el análisis de esfuerzos en las tuberías

PASS/START-PROF Hace simple lo complejo

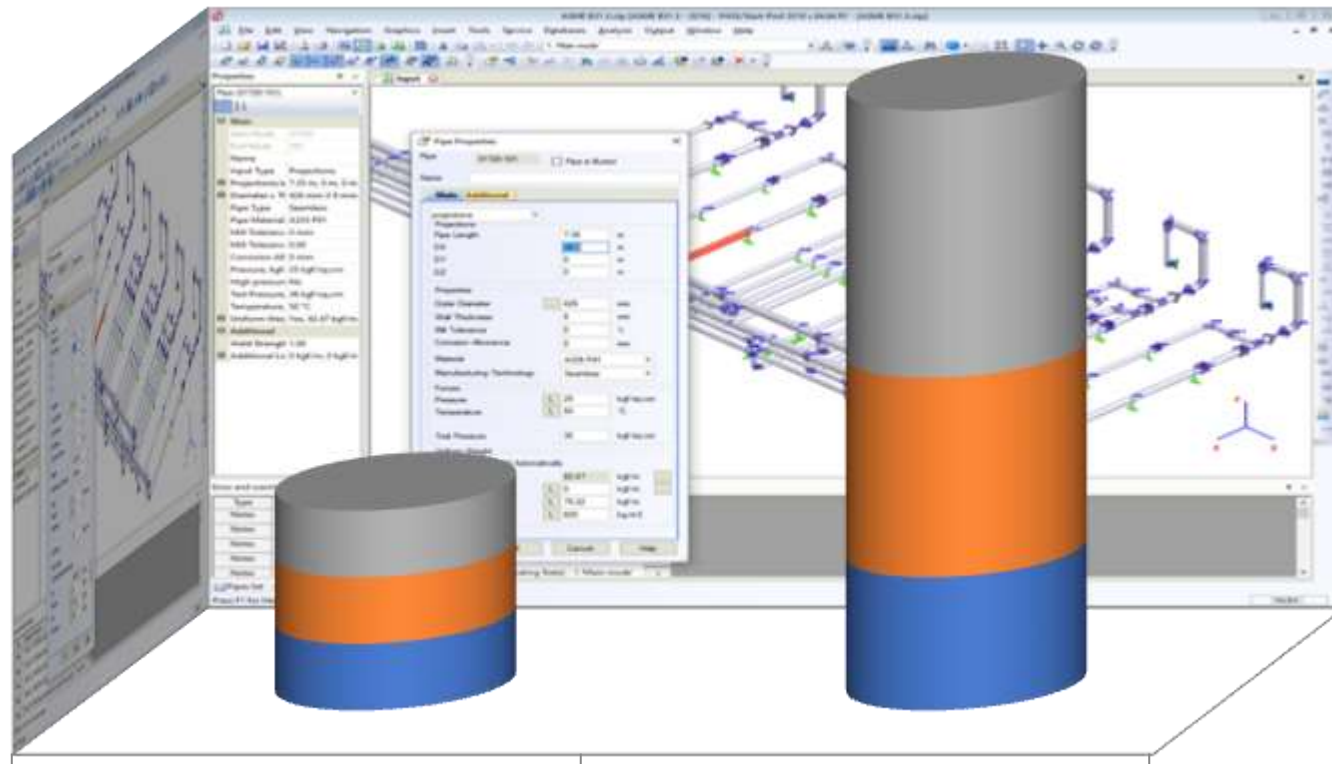
Obtendrá los mismos resultados pero más fácil y más rápidamente



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# PASS/Start-Prof | Cómo START-PROF le ahorra tiempo



START-PROF

Other Pipe Stress Software

- Time to Create the Model
- Time to Analyze and Optimize the Model
- Time to Create the Report



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# PASS/Start-Prof | Códigos para tuberías Incluidos

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PASS/START-PROF Puede analizar de acuerdo con 32 códigos de tuberías. Incluye todo lo requerido para el análisis conforme con las últimas ediciones de los códigos para Proceso y Fuerza:

- ASME B31.1
- ASME B31.3
- ASME B31.12
- EN 13480
- DL/T 5366 (China)
- GB 50316 (China)
- GB 20801 (China)
- RD 10-249-98 (Russia)
- GOST 32388 (Russia)
- ISO 14692 FRP/GRP/GRE
- Thermoplastic Piping (HDPE, PVC, PP, PVDF)



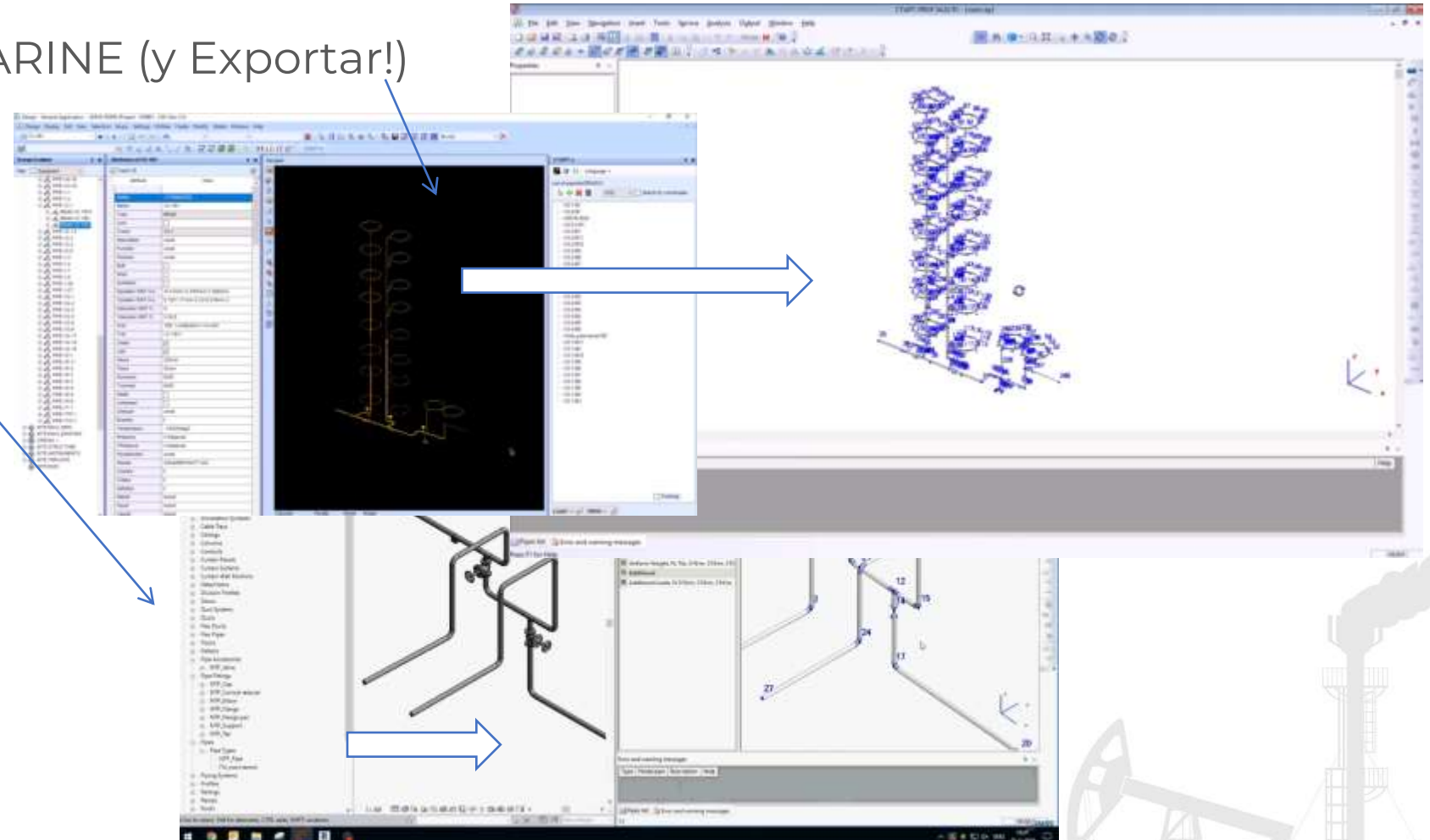
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# PASS/Start-Prof | Interfaces con otro software

PASS/START-PROF puede importar modelos desde

- AVEVA PDMS, E3D, MARINE (y Exportar!)
- SmartPlant 3D
- Autodesk Revit
- OpenPlant
- AutoPlant
- CADWorx
- Smart 3D
- CAESAR II
- Autopipe
- PASS/HYDROSYSTEM
- PCF



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# PASS/Start-Prof | Creación del modelo

En START-PROF la creación del modelo es simple, clara y directa.  
Un principiante sabrá qué hacer.

Crear el modelo de la tubería y el equipo es como combinar objetos como en un LEGO

- Rápida creación del modelo
- Fácil y rápida modificación del modelo
- Puede agregar, eliminar, modificar, copiar, rotar, duplicar, dividir objetos
- Trabajar con grupos de objetos

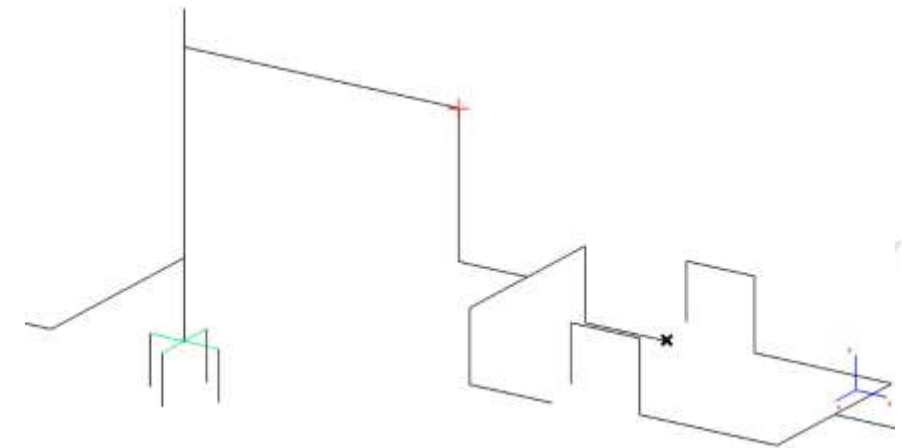
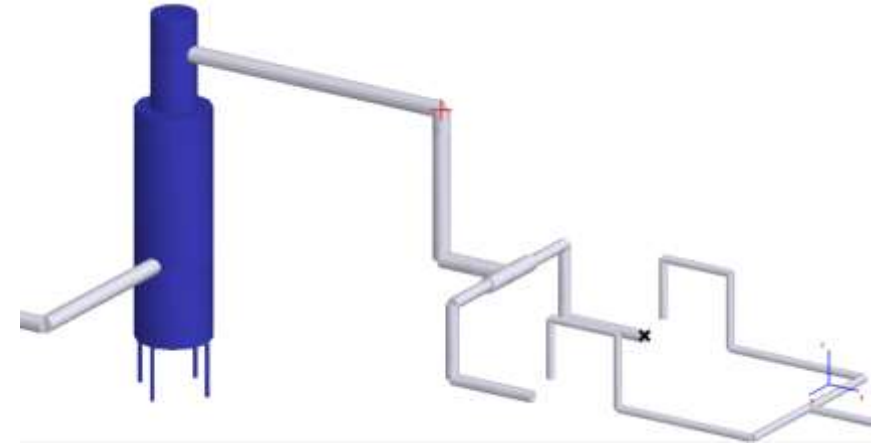
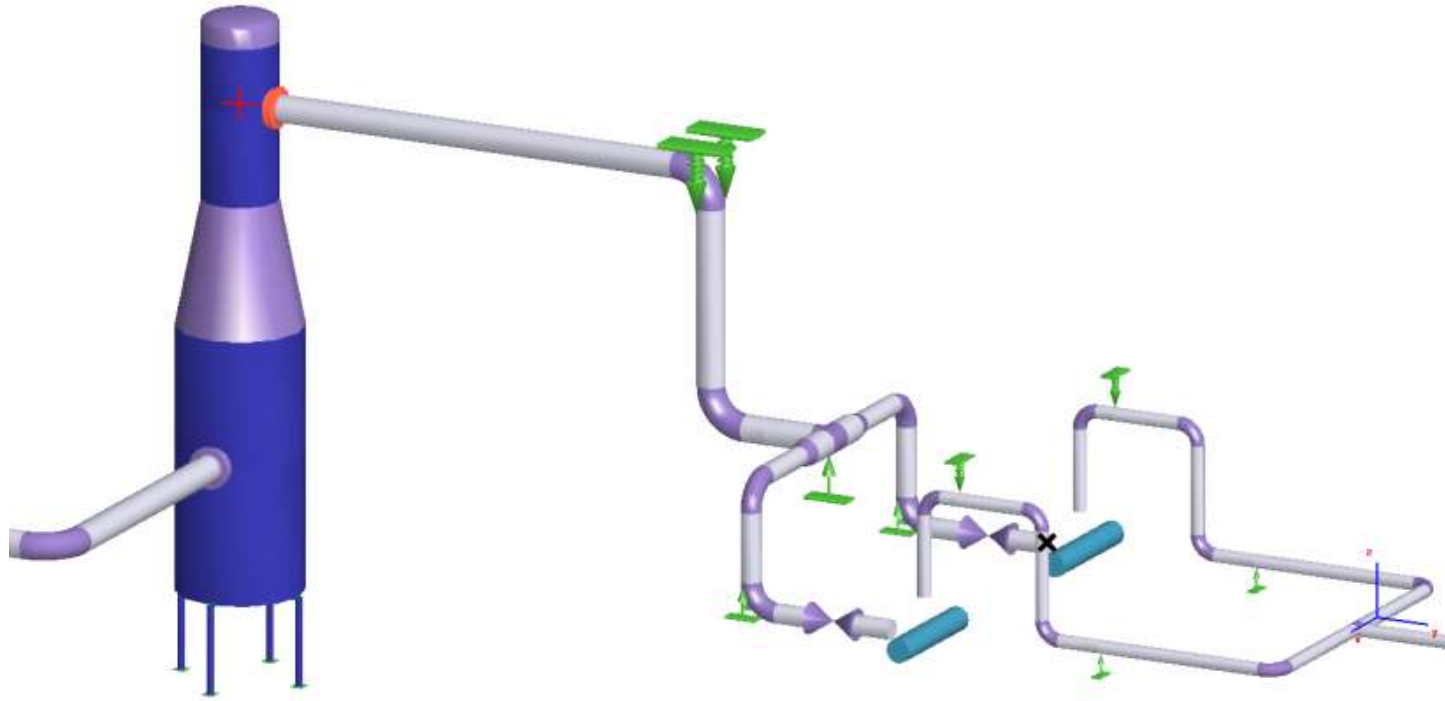


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# PASS/Start-Prof | Creación del modelo



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# PASS/Start-Prof | Creación del modelo

Objeto Cylindrical Shell

Objeto tubo

Objeto element rígido

Insert Pipe... F7  
Insert Rigid Element...  
Cylindrical Shell...

Pipe Properties

Main	
Start Node	18
End Node	3
Name	
Input Type	Projections
Projections/angles	0 m, 4 m, 0 m
Diameter x Thickness, m	219 mm X 6 mm
Pipe Type	Seamless
Pipe Material	A106 A
Mill Tolerance, %	10.00
Corrosion Allowance, m	0.9 mm
Pressure, kgf/sq.cm	16 kgf/sq.cm
High pressure	No
Test Pressure, kgf/sq.cm	20 kgf/sq.cm
Temperature, °C	150 °C
Uniform Weight, kg/m	Yes, 31.45 kgf/m, No, 24.8 kgf/m
Calculate Weight Aut	Yes
Uniform Weight, kgf	31.45 kgf/m
Input Insulation Prop	No
Uniform Insulation W	24.8 kgf/m
Uniform Fluid Weight	33.85 kgf/m
Fluid Density, kg/m3	1000 kg/m3
Additional	
Weld Strength Factor, E	1.00
Additional Loads, kgf/m	0 kgf/m, 0 kgf/m, 0 kgf/m, C
Weight Load, kgf/m	0 kgf/m
Load X, kgf/m	0 kgf/m
Load Y, kgf/m	0 kgf/m
Load Z, kgf/m	0 kgf/m

Pipe Properties

Pipe 18-3  Pipe is Buried

Name

Main Additional

Selection

Projections

Pipe Length	4 m
DX	0 m
DY	4 m
DZ	0 m

Properties

Outer Diameter	219 mm
Wall Thickness	6 mm
Mill Tolerance	10 %
Corrosion Allowance	0.9 mm
Material	A106 A
Manufacturing Technology	Seamless

Forces

Pressure	L 16 kgf/sq.cm
Temperature	L 150 °C

Test Pressure 20 kgf/sq.cm

Uniform Weight

Auto Pipe Weight  Auto Weight Insulation

Pipe	31.45 kgf/m
Insulation	L 24.8 kgf/m
Fluid	L 33.85 kgf/m
Fluid Density	L 1000 kg/m3

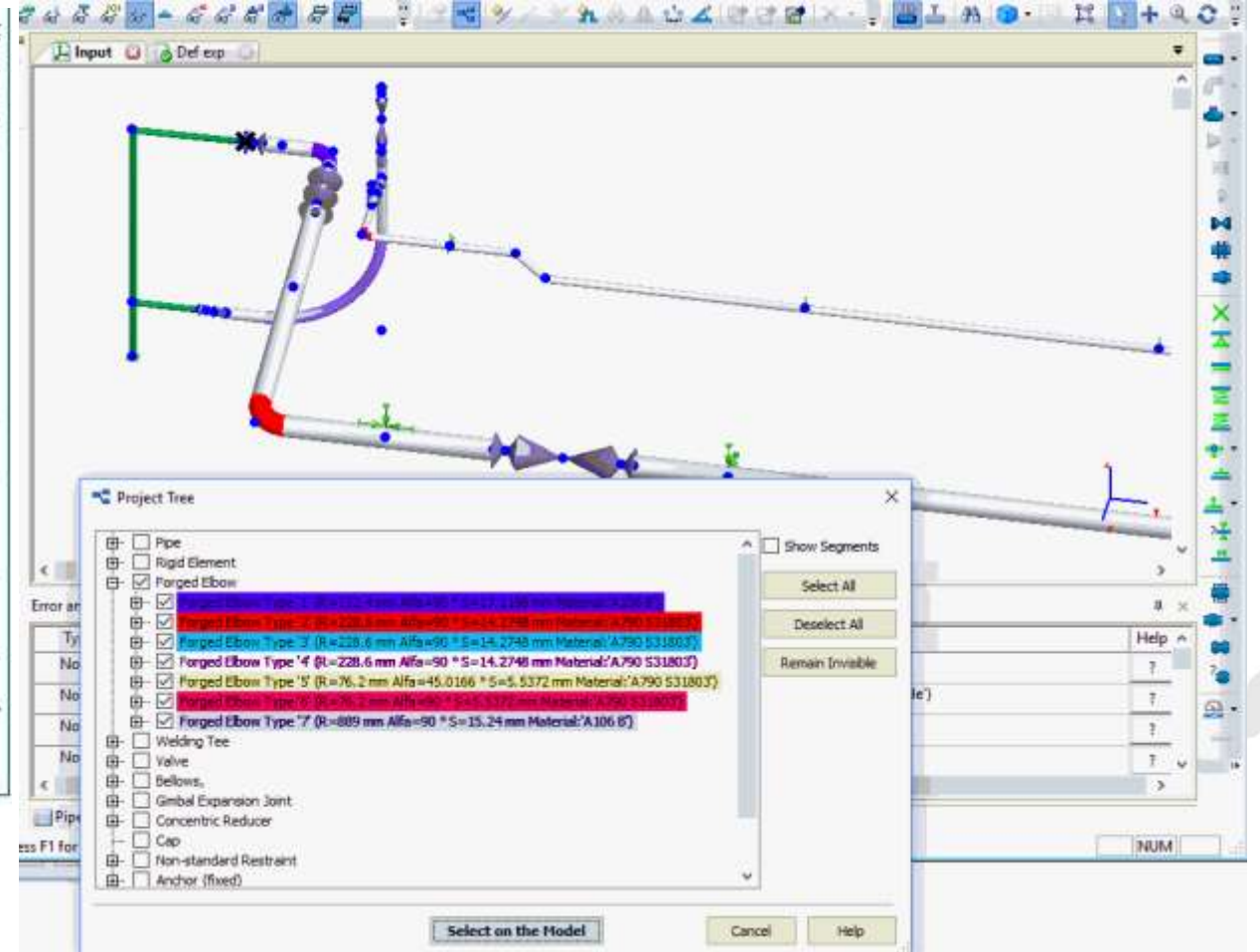
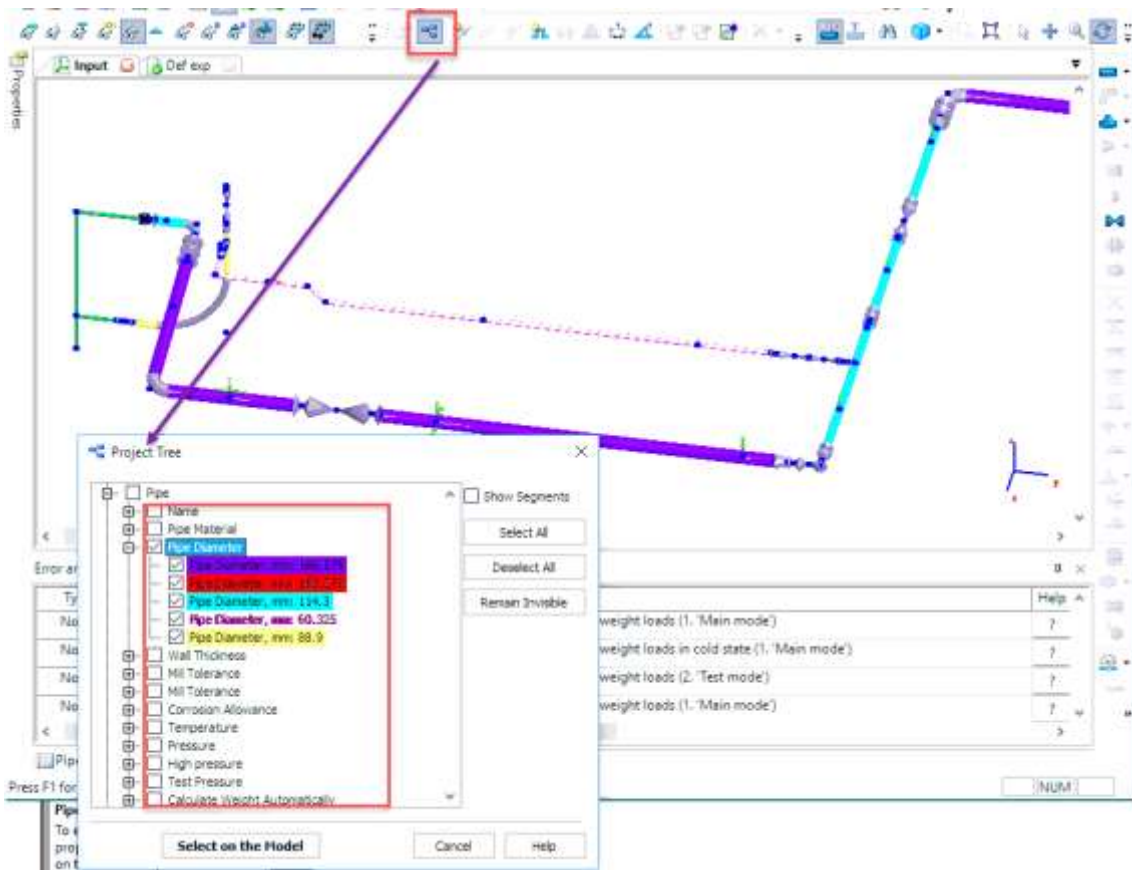
OK Cancel Help

Insulation Thickness, s 0 mm  
Insulation Density 0 kg/m3  
Cladding Thickness, tc 0 mm  
Cladding Density 0 kg/m3  
Lining Thickness, s 0 mm  
Lining Density 0 kg/m3

1 2 3 4

# PASS/Start-Prof | Creación del modelo

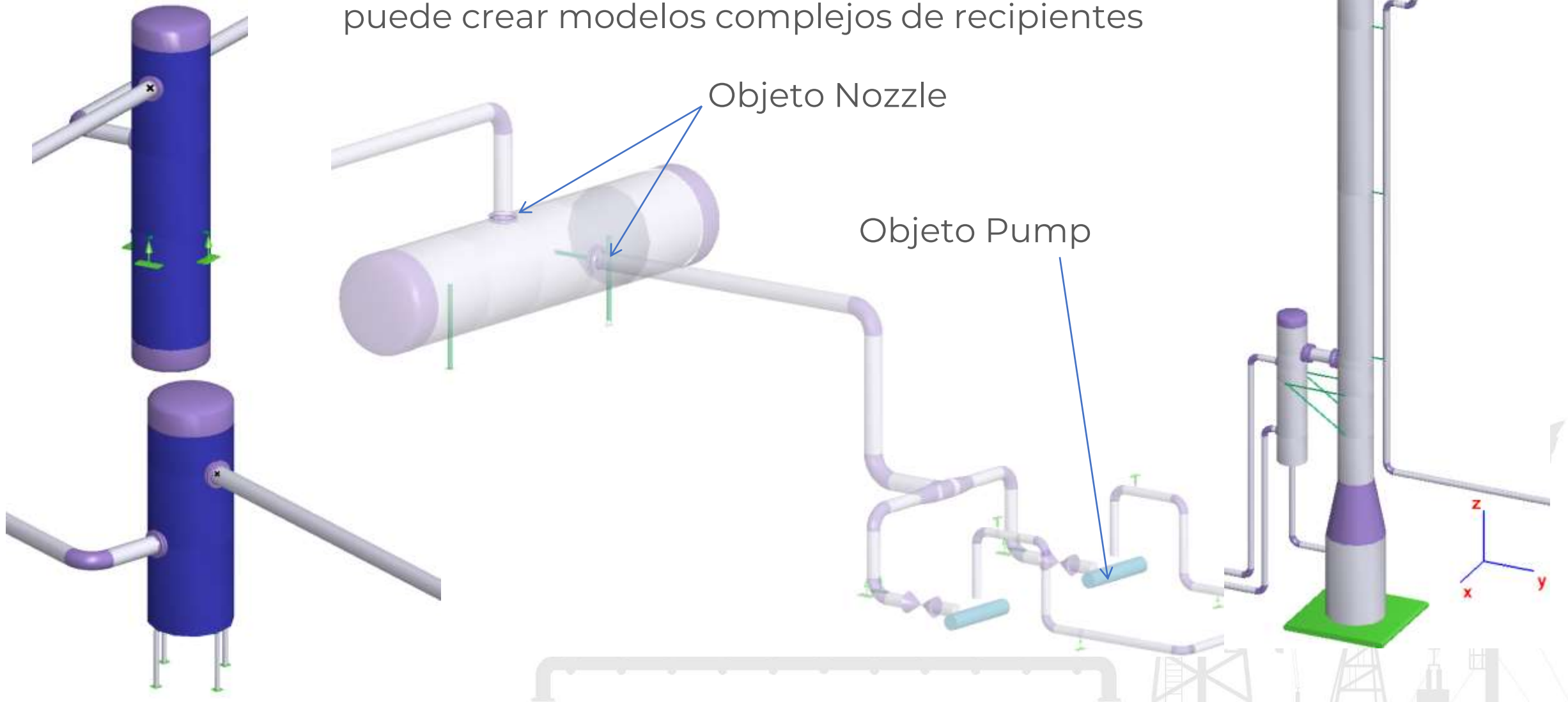
Mapa de colores de propiedades de cualquier objeto: diámetro, temp., presión, material...



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# PASS/Start-Prof | Creación del model

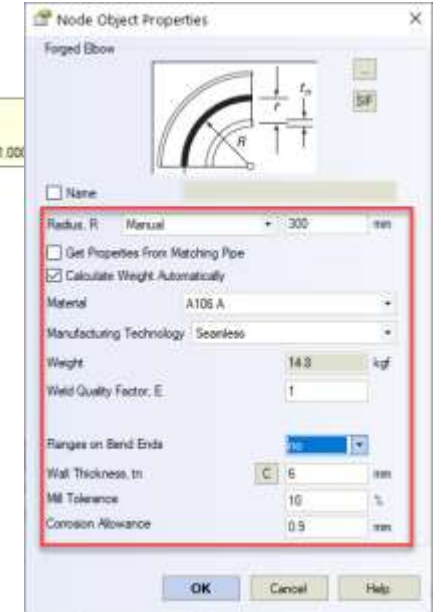
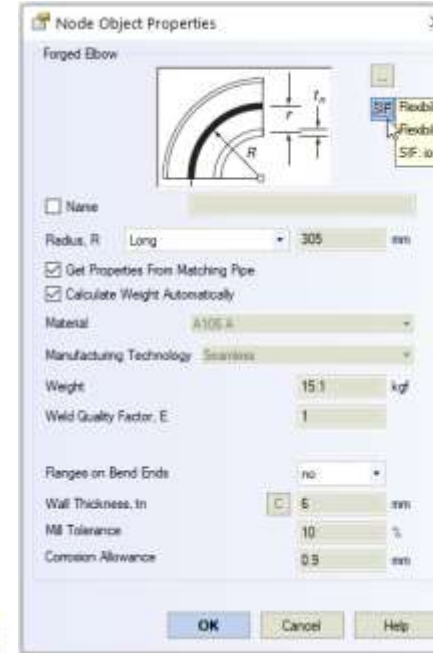
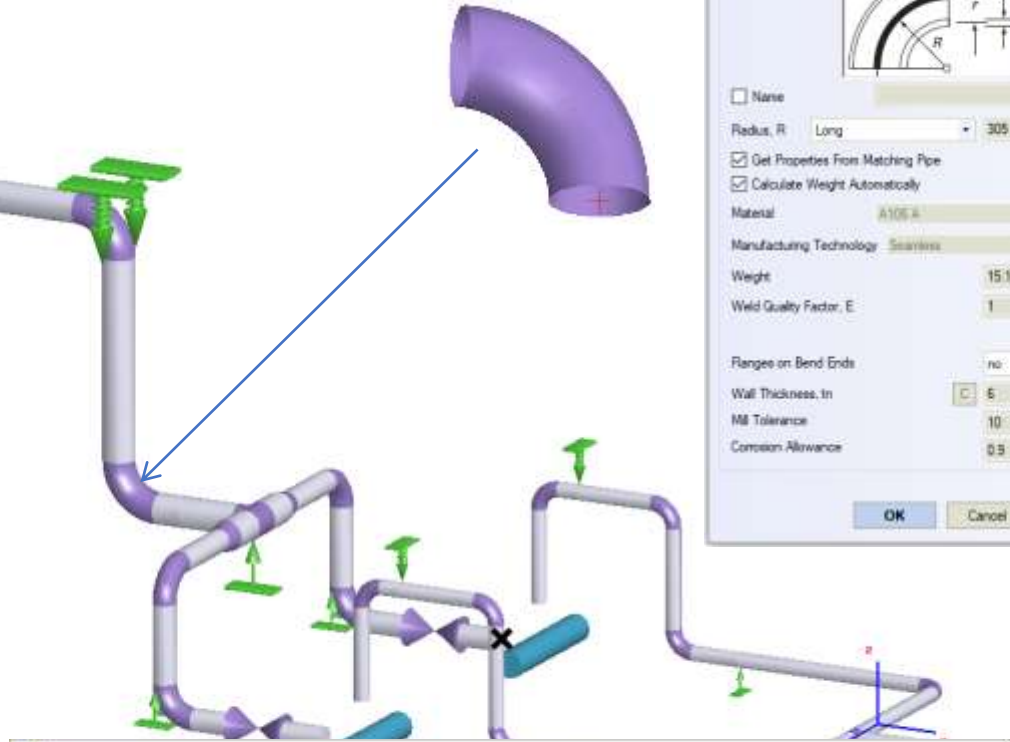
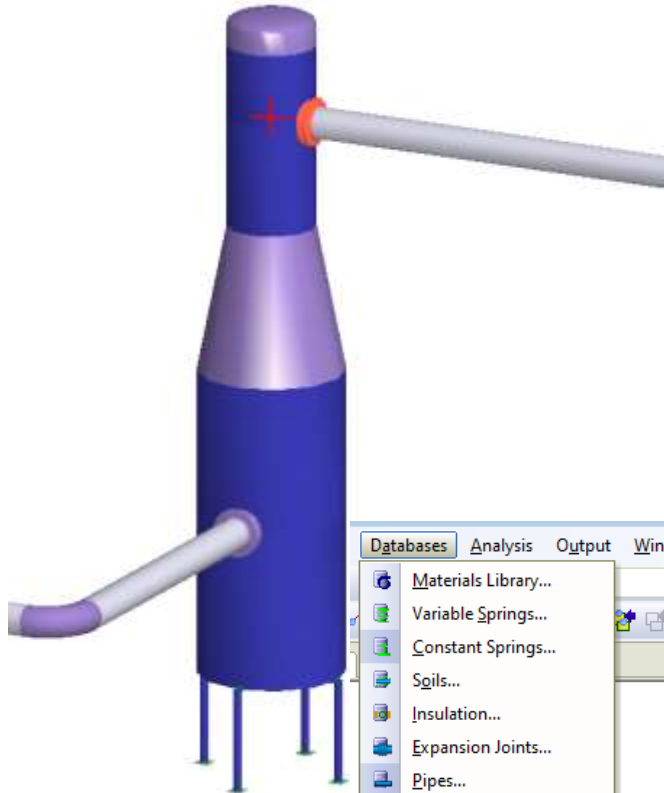
Con los Objetos Cylindrical Shell, Nozzle, Rigid y Pipe puede crear modelos complejos de recipientes



# PASS/Start-Prof | Creación del modelo

Los Objetos pueden ser copiados o eliminados

Objeto Bend



Bends

Type	Material	Size	Angle	Diameter, mm	SH, mm	HFL, mm	Schedule	Thickness, mm	SAB Subtance Corrosion, mm	SAB Subtance Corrosion, mm	SAB Subtance Corrosion, mm	Radius, mm	Weight, kg	Dilatation Factor	Radius Type	Standard Class
Forged Elbow	ASME B16.9-2012	90-90.3	90	60.3	30	2	160	3	0	0	0	15	0.5	0	long	ASME
Forged Elbow	ASME B16.9-2012	90-90.3	90	60.3	30	2	160	3	0	0	0	15	0.04	0	long	ASME
Forged Elbow	ASME B16.9-2012	90-90.3	90	60.3	30	2	160	3	0	0	0	15	1.3	0	long	ASME
Forged Elbow	ASME B16.9-2012	90-90.3	90	60.3	30	2	140	0	0	0	0	15	0	0	long	ASME
Forged Elbow	ASME B16.9-2012	90-90.3	90	60.3	30	2	120	0	0	0	0	15	0	0	long	ASME
Forged Elbow	ASME B16.9-2012	45-75	45	75	45	2	112	0	0	0	0	15	0	0	long	ASME
Forged Elbow	ASME B16.9-2012	45-75	45	75	45	2	112	0	0	0	0	15	0	0	long	ASME
Forged Elbow	ASME B16.9-2012	45-75	45	75	45	2	112	0	0	0	0	15	1	0	long	ASME
Forged Elbow	ASME B16.9-2012	45-75	45	75	45	2	112	0	0	0	0	15	0	0	long	ASME

- Forged Elbow...
- Pipe Bend...
- Miter Bend (Closely Spaced)...
- Welding Elbow...
- Long Radius Pipe Bend...
- Prestressed Pipe Bend...
- Miter Joint (Widely Spaced)...
- Non-standard Bend...

# PASS/Start-Prof | Creación del modelo

**Objeto Tee**

Welding Tee...  
 Fabricated (Reinforced/Unreinforced)...  
 Stub-in...  
 Extruded Outlet...  
 Weldolet (Branch Welded-on Fitting)...  
 Sweepolet (Welded-in Contour Insert)...  
 Plastic Tee...  
 Non-standard Tee...

Node Object Properties  
 Welded Stub-in (Fabricated Tee)  
 Flexibility (k): 0.155  
 Run SIF:  $i_0 = 3.116, i_1 = 2.587, i_2 = 1.000, i_3 = 1.000$   
 Branch SIF:  $i_0 = 3.116, i_1 = 2.587, i_2 = 1.000, i_3 = 1.000$

Project Settings... - Ex4-Pump.otp  
 General Additional Seismic Wind, Snow, Ice Other Dynamic  
 Date: 15/02/2018 Description:  
 Piping Type: All  
 Stress Analysis Code: ASME B31.3-2018 Process Piping (USA)  
 Use E<sub>h</sub> for Support Loads  
 Liberal Stress Allowable  
 Stress Range from Operation to Cold  
 Use ASME B31J SIFs and k-factors  
 Use k-factors  
 Maximum f=1.2

Node Object Properties  
 Welded Stub-in (Fabricated Tee)  
 Run SIF:  $i_0 = 3.169, i_1 = 3.792, i_2 = 4.506, i_3 = 1.009$   
 Branch SIF:  $i_0 = 6.383, i_1 = 3.898, i_2 = 4.493, i_3 = 1.000$

ASME B31J

Manufacturing Technology	Standard	Material	Size	Header Diameter, mm	Branch Diameter, mm	Header DN, mm	Branch DN, mm	Header SPC, in	Branch SPC, in	Schedule	Header Thickness, mm	Branch Thickness, mm	Header SMI Tolerance, mm	Branch SMI Tolerance, mm	Full Length, mm	Crutch Height, mm	Crutch Radius, mm	Weight, kg	Standard Group
Welded Tee	ASME B16.9-2012	Welded Tee	42.2-21.3	42.2	21.3	32	15	1 1/4	1/2	30	0	0	0	0	36	48	0	0	ASME
Welded Tee	ASME B16.9-2012	Welded Tee	42.2-21.3	42.2	21.3	32	15	1 1/4	1/2	80	0	0	0	0	36	48	0	0	ASME
Welded Tee	ASME B16.9-2012	Welded Tee	42.2-26.7	42.2	26.7	32	20	1 1/4	3/4	120	0	0	0	0	36	48	0	0	ASME
Welded Tee	ASME B16.9-2012	Welded Tee	42.2-26.7	42.2	26.7	32	20	1 1/4	3/4	100	0	0	0	0	36	48	0	0	ASME
Welded Tee	ASME B16.9-2012	Welded Tee	42.2-26.7	42.2	26.7	32	20	1 1/4	3/4	180	0	0	0	0	36	48	0	0	ASME
Welded Tee	ASME B16.9-2012	Welded Tee	42.2-26.7	42.2	26.7	32	20	1 1/4	3/4	140	0	0	0	0	36	48	0	0	ASME
Welded Tee	ASME B16.9-2012	Welded Tee	42.2-26.7	42.2	26.7	32	20	1 1/4	3/4	X85	0	0	0	0	36	48	0	1	ASME
Welded Tee	ASME B16.9-2012	Welded Tee	42.2-26.7	42.2	26.7	32	20	1 1/4	3/4	70	0	0	0	0	36	48	0	0	ASME
Welded Tee	ASME B16.9-2012	Welded Tee	42.2-26.7	42.2	26.7	32	20	1 1/4	3/4	70	0	0	0	0	36	48	0	0	ASME



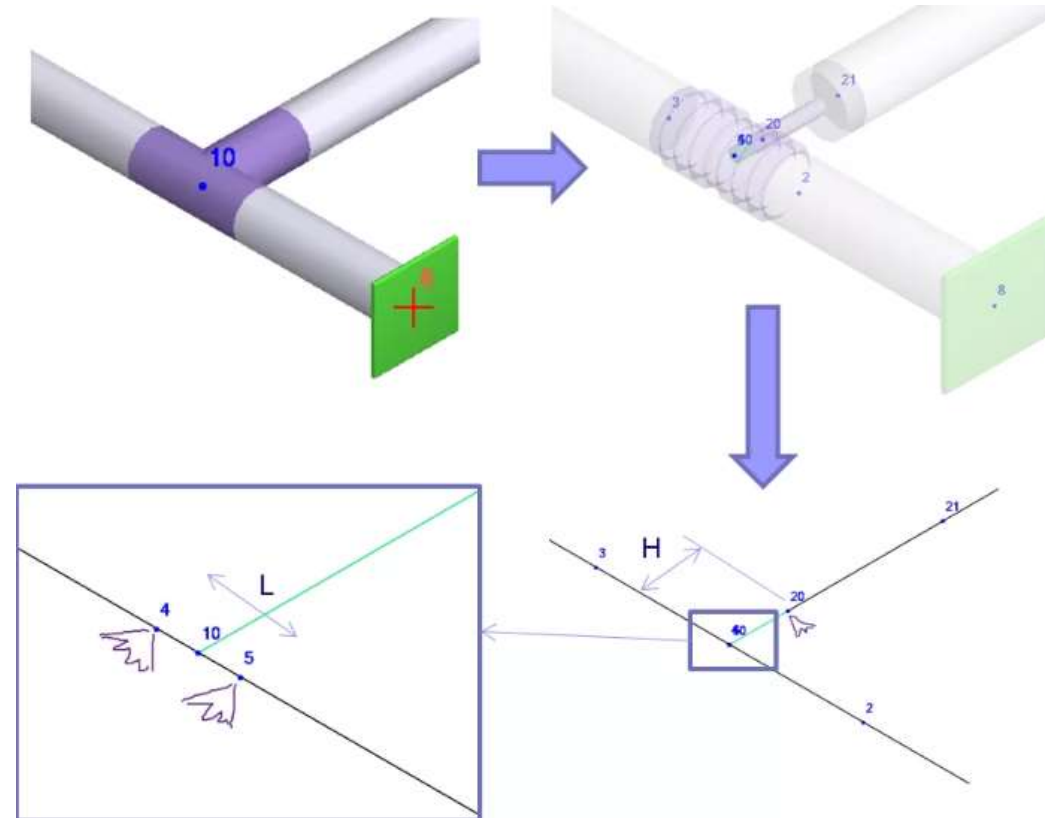
# PASS/Start-Prof | Creación del modelo

## Modelado automático a detalle de Tee

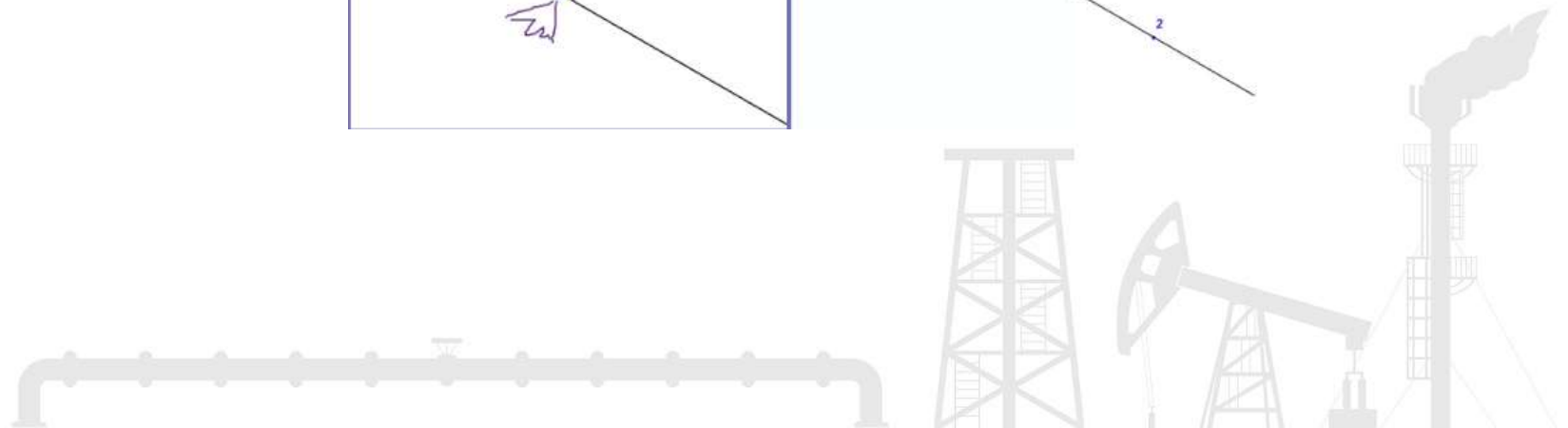
- Elementos rígidos
- Flexibilidades del cabezal y ramales
- Se considera los espesores de pared del cabezal y ramales

## Considera SIF para cabezal y ramales

- De acuerdo con el Código
- De acuerdo con ASME B31J
- Desde FEA (Nozzle-FEM Software)



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# PASS/Start-Prof | Creación del modelo

Objeto Reducción

ASME B31J

The image displays the PASS software interface for creating a piping model. A 3D model of a piping system is shown on the left, featuring a vertical vessel and various pipe segments connected by reducers. A callout box above the model offers options for 'Concentric Reducer...' and 'Eccentric Reducer...'. A 'Node Object Properties' dialog box is open, showing a technical drawing of a concentric reducer and its parameters:

- Concentric Reducer
- Material: AISI A
- Weld Quality Factor, E: 1
- Maximum Diameter, D1: 219 mm
- Thickness, T1: 6 mm
- Minimum Diameter, D2: 159 mm
- Thickness, T2: 5 mm
- Cone Length, L: 122 mm
- Radius, r2: 0 mm
- Length, L2: 0 mm
- Weight: 3 kgf

The 'Project Settings' dialog box is also open, with the 'Dynamic' tab selected. The 'Use ASME B31J SIFs and k-factors' checkbox is checked and highlighted with a red box. Other settings include 'Date: 10/12/2019', 'Piping Type: All', and 'Stress Analysis Code: ASME B31.3-2018 Process Piping (USA)'. A tooltip for the SIF parameter shows:  $SIF: k=1.386, s=1.386, q=1.000, l=1.000$ .

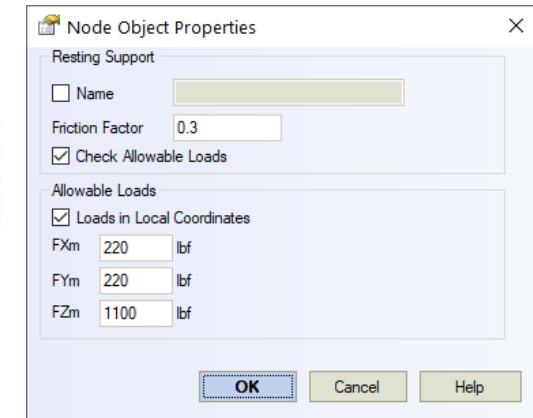
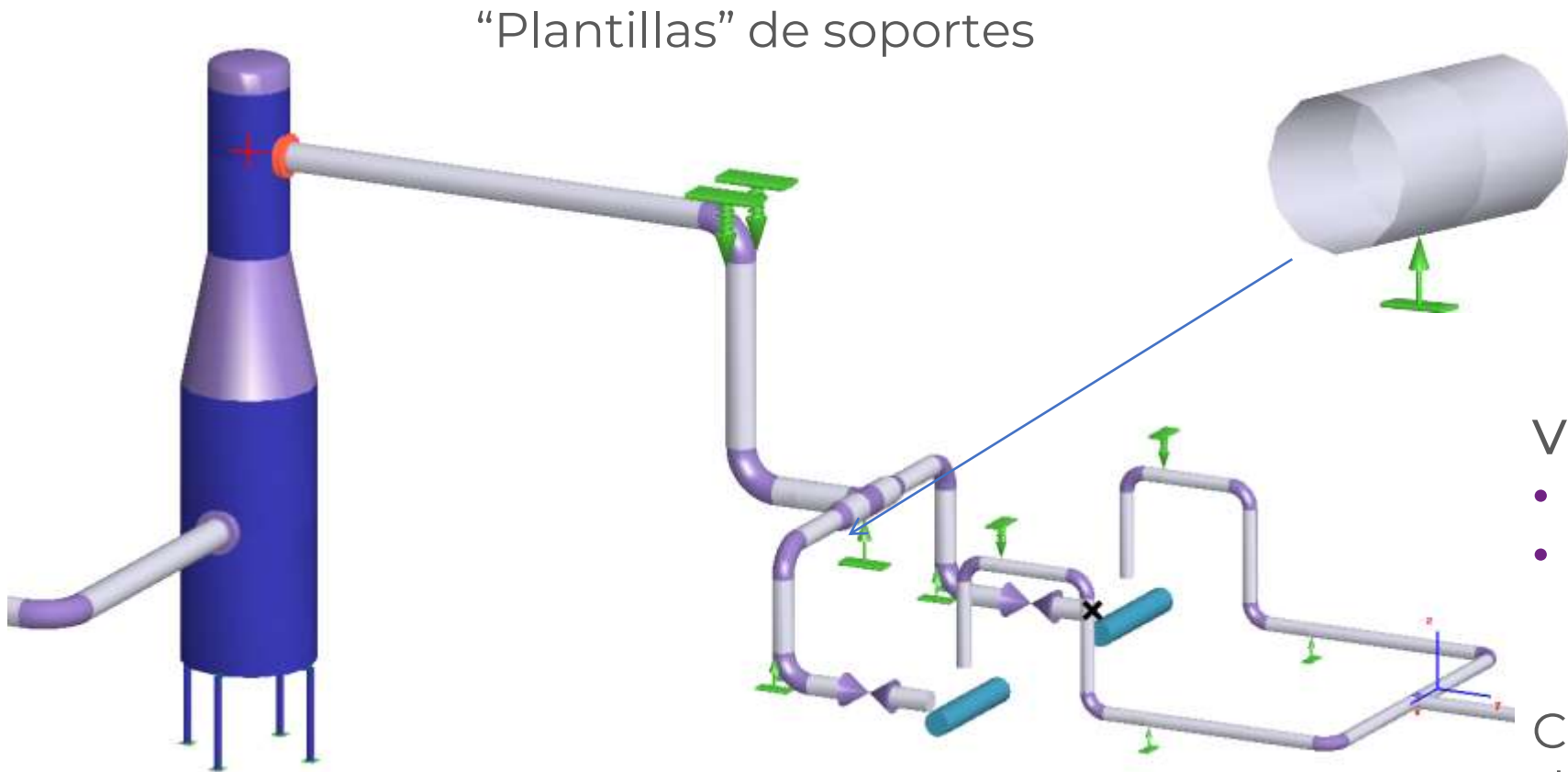
At the bottom, the 'Reducers' table lists various reducer specifications:

Manufacturing Technology	Standard	Material	Size	Diameter min, mm	Diameter max, mm	Nominal Diameter min, mm	Nominal Diameter max, mm	NPS min, in	NPS max, in	Schedule	Thickness at Draw, mm	Thickness at Draw, mm	Min Thickness at Draw, mm	Min Thickness at Draw, mm	Full Length, mm	Cone Length, mm
<next>	ASME B16.9-2012	<next>	20-10	26.7	17.5	20	10	3/4	1/8	33	0	0	0	38	22.8	
<next>	ASME B16.9-2012	<next>	20-10	26.7	17.5	20	10	3/4	1/8	33	0	0	0	38	22.8	
<next>	ASME B16.9-2012	<next>	20-10	26.7	17.5	20	10	3/4	1/8	33	0	0	0	38	22.8	
<next>	ASME B16.9-2012	<next>	20-10	26.7	17.5	20	10	3/4	1/8	33	0	0	0	38	22.8	
<next>	ASME B16.9-2012	<next>	20-10	26.7	17.5	20	10	3/4	1/8	33	0	0	0	38	22.8	
<next>	ASME B16.9-2012	<next>	20-10	26.7	17.5	20	10	3/4	1/8	33	0	0	0	38	22.8	
<next>	ASME B16.9-2012	<next>	20-10	26.7	17.5	20	10	3/4	1/8	33	0	0	0	38	22.8	
<next>	ASME B16.9-2012	<next>	20-10	26.7	17.5	20	10	3/4	1/8	33	0	0	0	38	22.8	





# PASS/Start-Prof | Creación del modelo



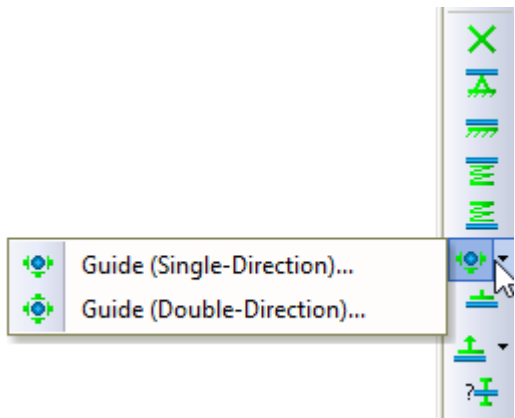
- Verifica automáticamente:
- Cargas permitidas
  - Soportes que se levantan (Lift Off)

Calcula cargas en Sistemas de coordenadas Global y local




PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Creación del modelo

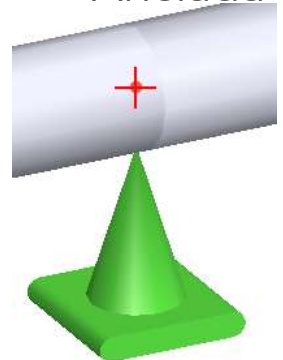


Selección automática de resortes Variable y Constante

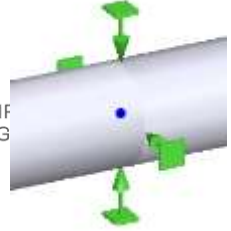
**Ancla**



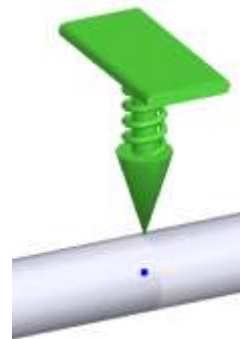
**Bisagra Anclada**



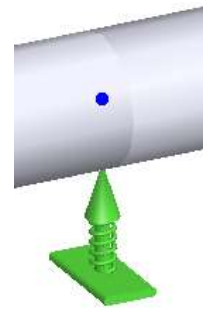
**Guía**



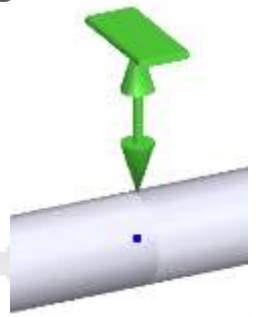
**Resorte Colgante**

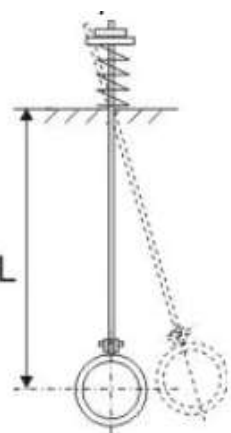


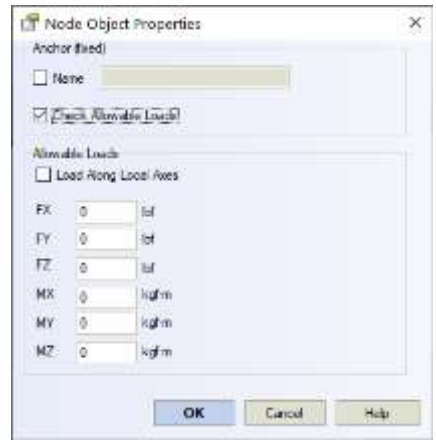
**Resorte**

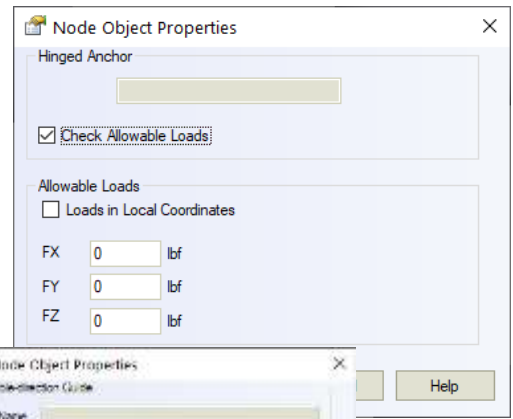



**Colgante constante**

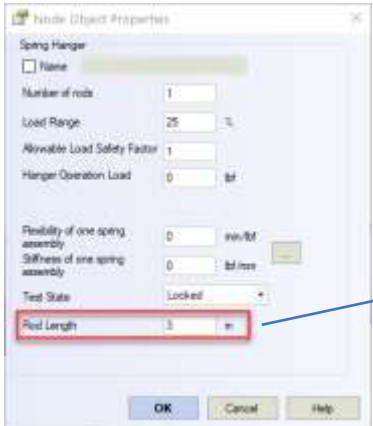


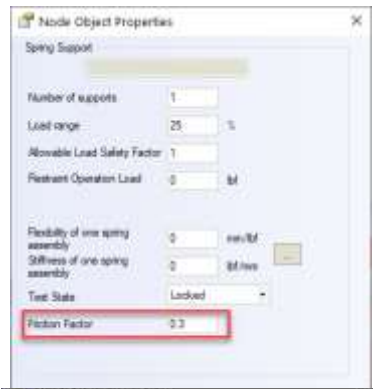













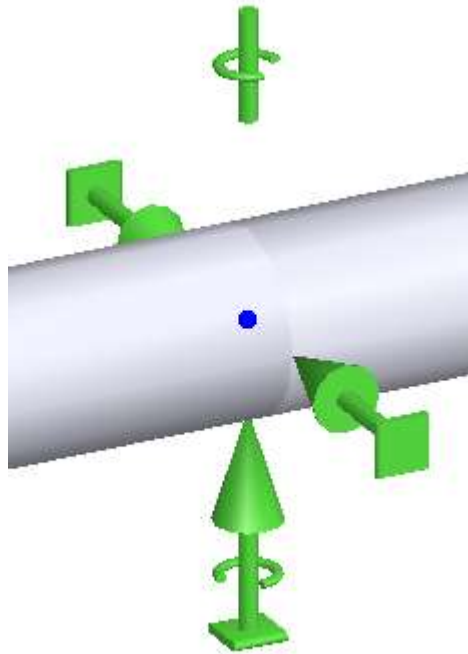




PIPING AND EQUIP  
ANALYSIS & SIZING

# PASS/Start-Prof | Creación del modelo

## Objeto Restricción Personalizada



Non-standard Restraint

Name:

Support N 1: Precompression Spring, X: 0 lbf; Precompression Spring, Y: 0 lbf; Precompression Spring, Z: 0 lbf

Test State: Unlocked

Local Axes of the Pipe: Pipe 31-52

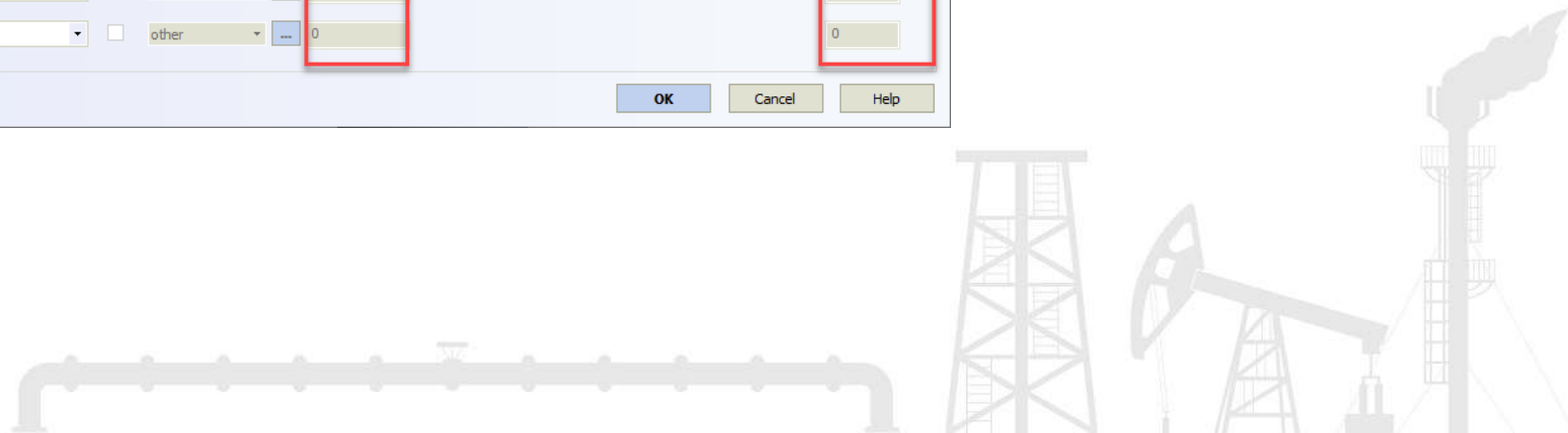
Check Allowable Loads

Use Gaps

Linear restraints								
	Local Axes	Restraint Direction	Flexibility, mm/lbf	Rod Length, m	Frict. Factor	Gap +, mm	Gap -, mm	Allowable Load, lbf
1.	rigid two-sided	+Ym Horizontal	0	0	0.3	0	0	0
2.	rigid one-sided	-Zm Ver/Horz	0	0	0.3	0	0	0
3.	none	other	0	0	0	0	0	0

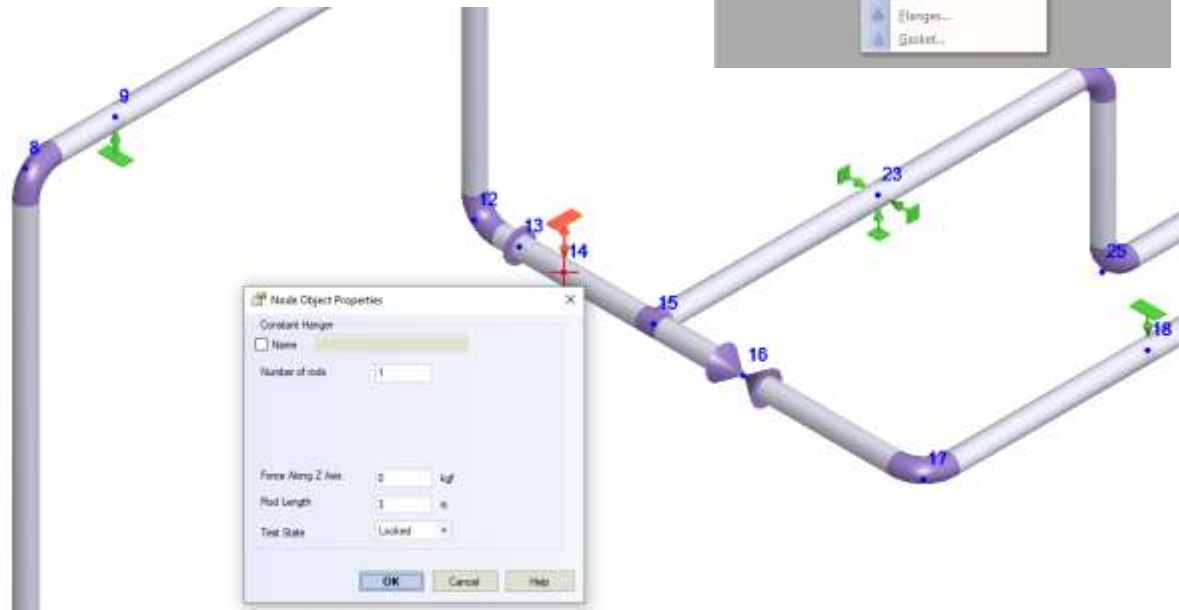
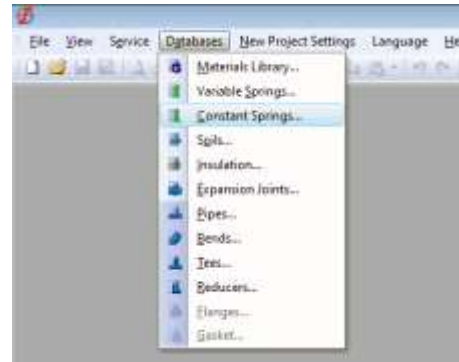
Rotational restraints				
	Local Axes	Restraint Direction Around Axis	Flexibility, °/kgf·m	Allowable Load, kgf·m
4.	rigid two-sided	+Z	0	0
5.	none	other	0	0
6.	none	other	0	0

OK Cancel Help



# PASS/Start-Prof | Creación del modelo

Selección automática de soportes de esfuerzo constante y colgantes



Constant Hangers and Supports

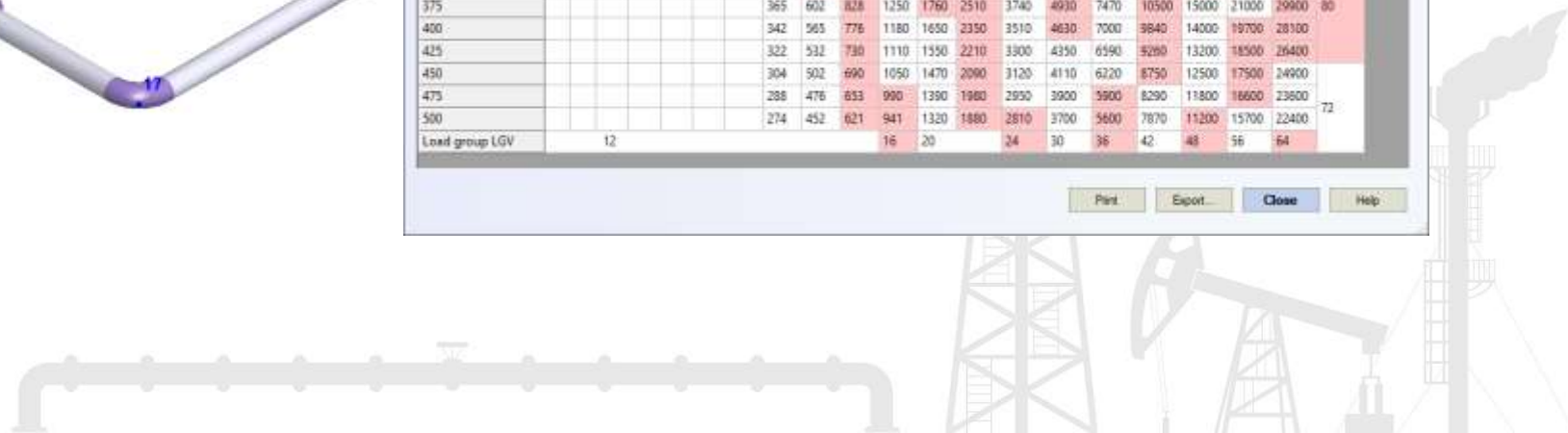
Standards: WITZEMANN

Restraint Type: Hanger

Nominal size	CH size																			Load group LGV
	7	8	9	10	11	12	13	14	15	16	17	18	19	20						
50																				
60	39	78	154	310	540	930	1540	2280	3770											
70	33	67	132	266	463	797	1320	1960	3230	4430	6100									
80	29	59	116	233	405	698	1150	1710	2820	3880	5880									
90	26	52	103	207	360	620	1030	1520	2510	3450	5230	7330	10500							
100	23	47	92	186	324	558	924	1370	2280	3100	4700	6600	9410	14000						
110	21	43	84	169	295	507	840	1250	2050	2820	4280	6000	8550	12800						
120	20	39	77	155	270	465	770	1140	1880	2590	3920	5500	7940	11700	15400					
130	18	36	71	143	249	429	710	1050	1740	2390	3620	5080	7240	10800	14200					
140	17	33	66	133	231	399	660	978	1610	2220	3360	4710	6720	10000	13200	20000				
150	16	31	62	124	216	372	616	913	1510	2070	3140	4400	6270	9350	12300	18700	26100			
160	15	29	58	116	203	349	577	856	1410	1940	2940	4120	5880	8770	11800	17500	24800			
170	14	28	54	109	191	326	543	806	1330	1830	2770	3880	5530	8250	10900	16500	23200	33800		
180	13	26	51	103	180	310	513	761	1260	1720	2610	3670	5230	7790	10300	15600	21900	31200	43500	
190	12	25	49	98	171	294	486	721	1190	1630	2480	3470	4950	7380	9740	14700	20700	29500	41400	
200	12	23	46	93	162	279	462	685	1130	1550	2350	3300	4700	7010	9250	14000	19100	28100	39400	
225	10	21	41	83	144	248	410	609	1000	1380	2090	2930	4180	6230	8220	12400	17500	24900	35000	
250	9	19	37	74	130	223	369	548	904	1240	1880	2640	3760	5610	7400	11200	15700	22400	31500	43500
275	9	17	34	68	118	203	336	498	821	1130	1710	2400	3420	5100	6730	10200	14300	20400	28600	40800
300	8	16	31	62	108	186	308	457	753	1030	1570	2200	3140	4680	6170	9340	13100	18700	26200	37400
325																				
350																				
375																				
400																				
425																				
450																				
475																				
500																				
Load group LGV	12									16	20		24	30	36	42	48	56	64	

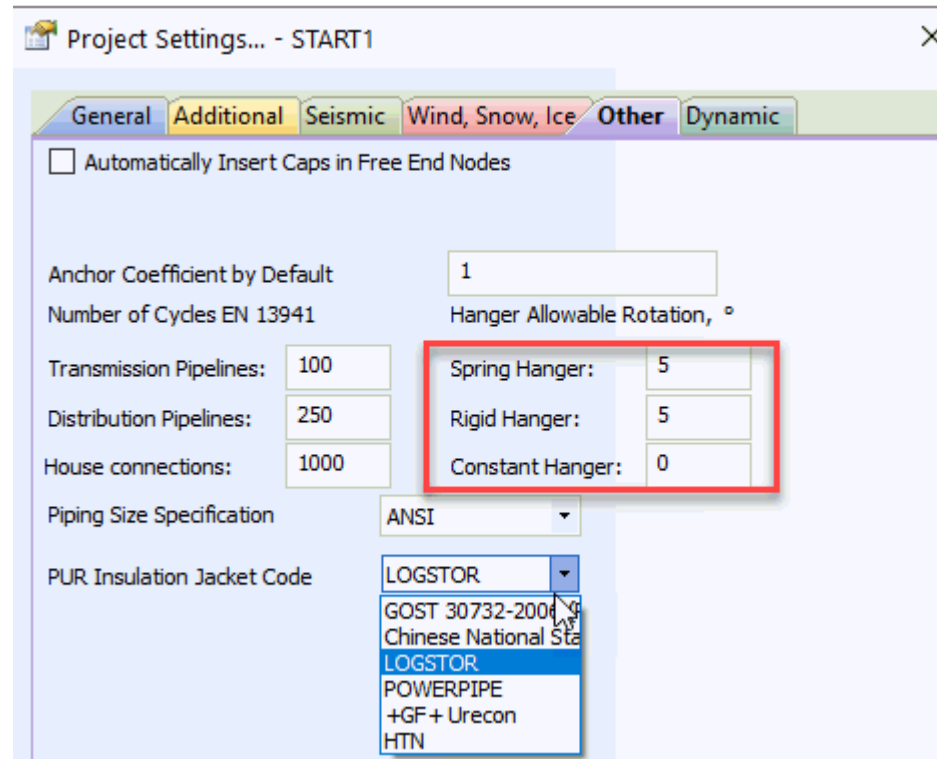


PIPING AND EQUIPMENT ANALYSIS & SIZING SUITE



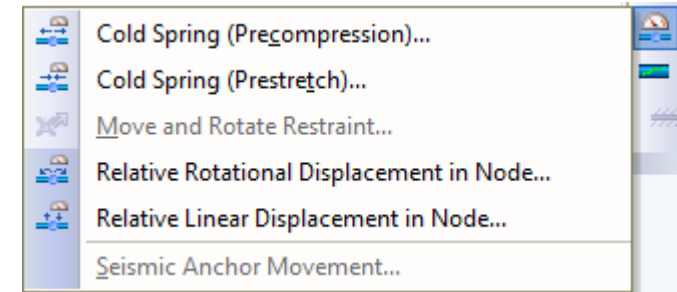
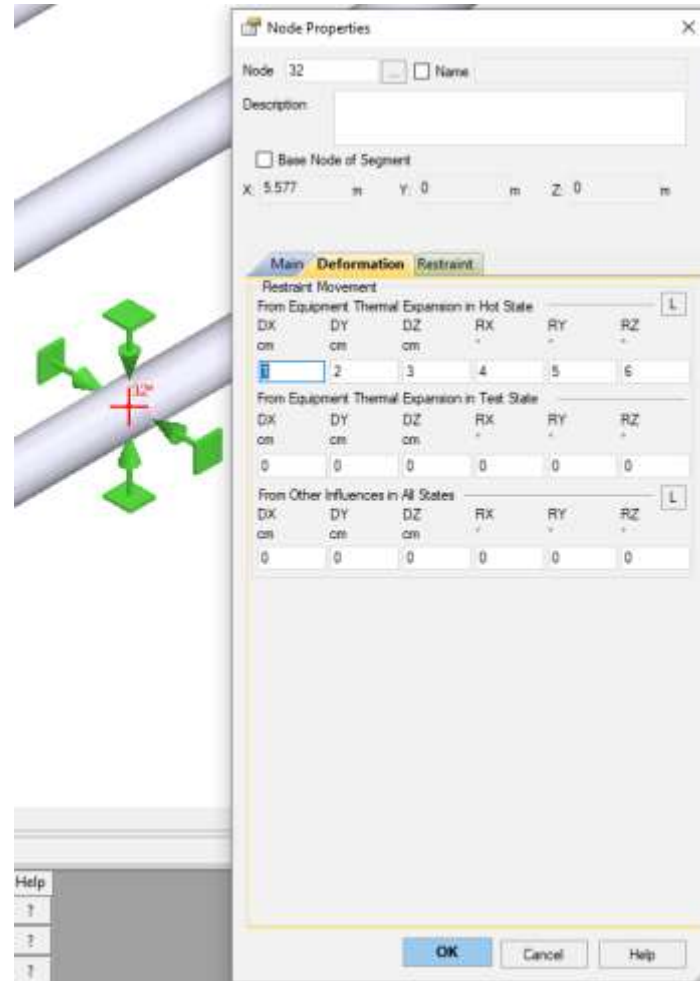
# PASS/Start-Prof | Creación del modelo

El usuario puede introducir el ángulo permisible de giro del soporte para diferentes tipos de resortes colgantes. START-PROF revisa automáticamente el ángulo de giro del soporte y muestra mensaje después del análisis en el caso donde la restricción no cumple.



# PASS/Start-Prof | Creación del modelo

Para especificar el movimiento del soporte, tan solo agregue el objeto desplazamiento al objeto soporte

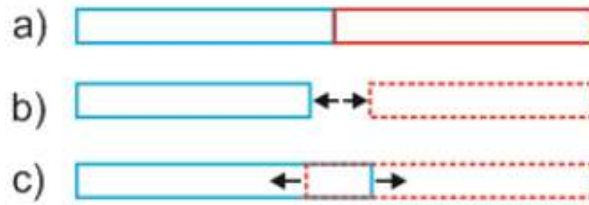
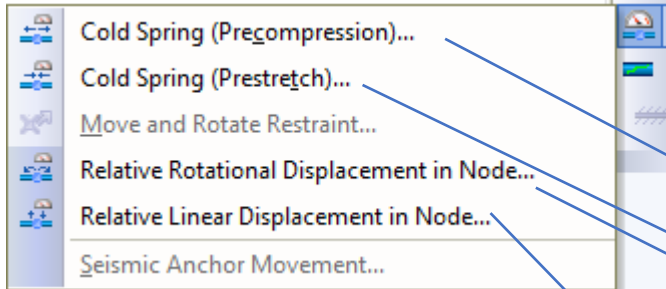


PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

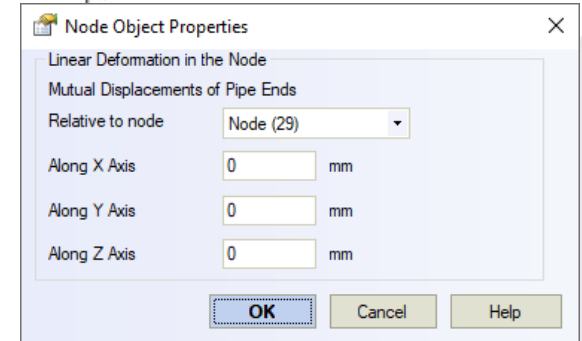
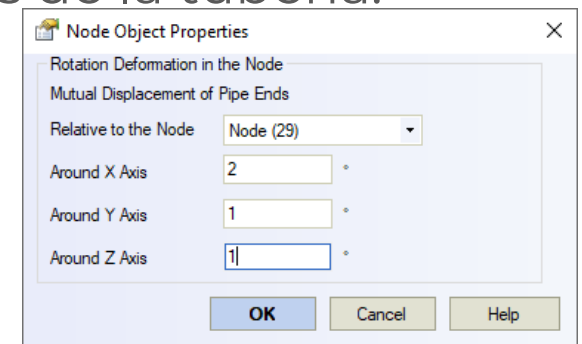
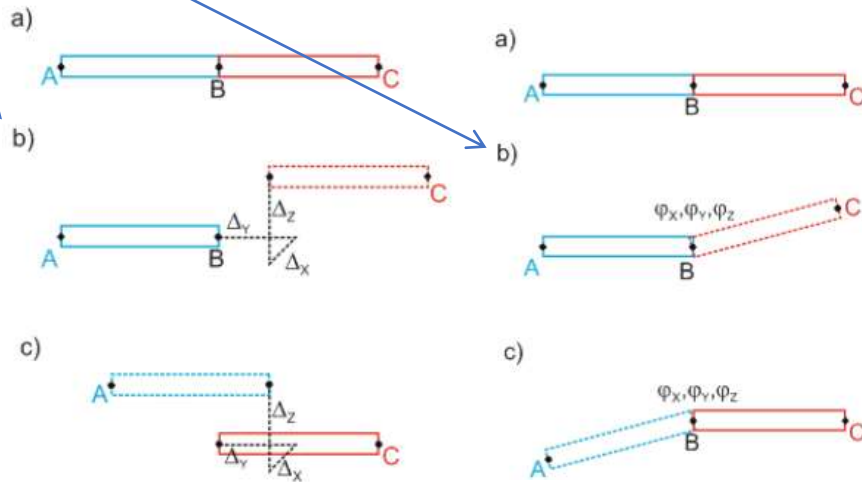
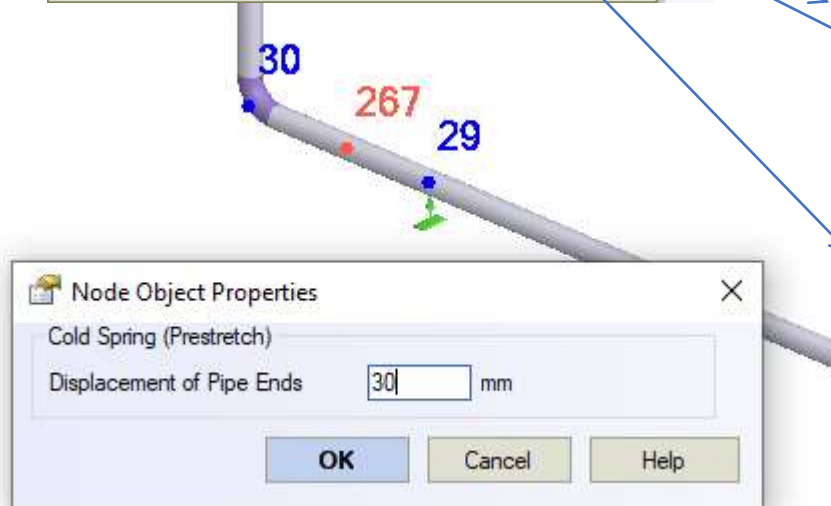


# PASS/Start-Prof | Creación del modelo

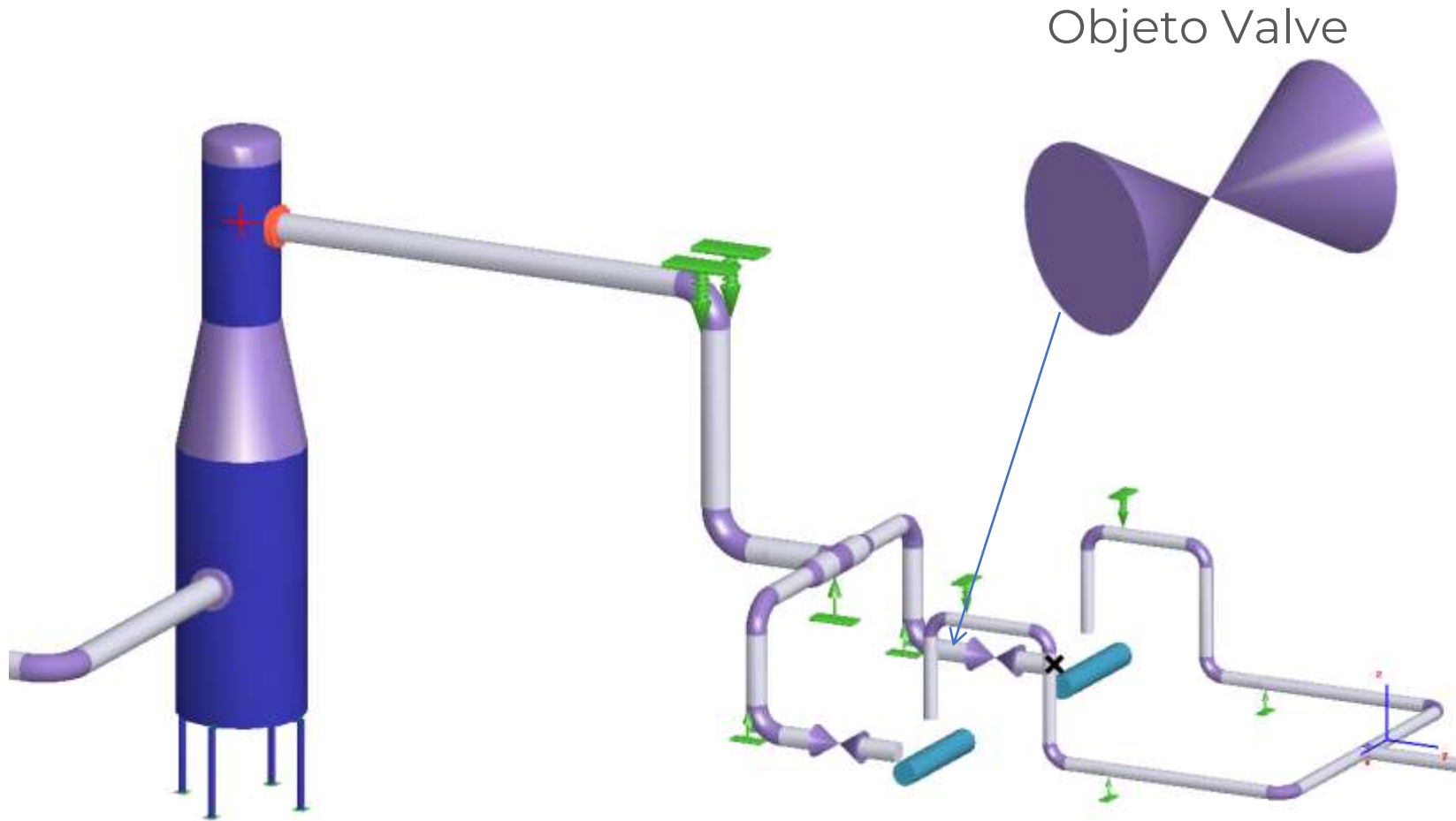
Para especificar el resorte en frío (alargamiento de la tubería mediante calentamiento), simplemente agregue el objeto “Cold Spring” al nodo



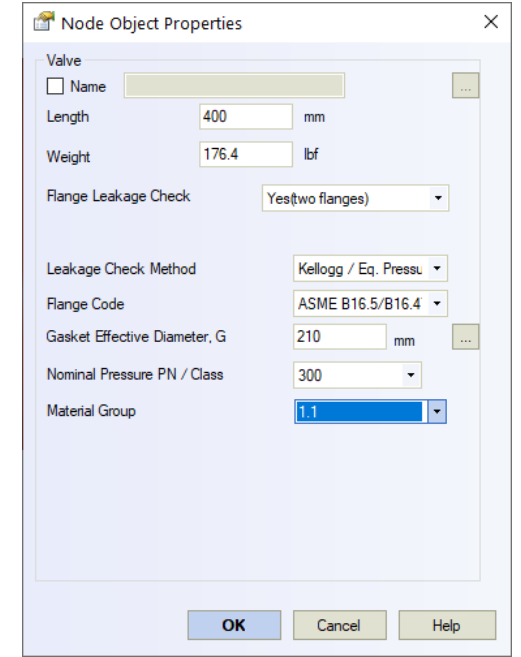
También pre-compresión y desplazamientos rotacionales o lineales relativos de los extremos de la tubería.



# PASS/Start-Prof | Creación del modelo



Objeto Valve



Automatic Flange Leakage Check



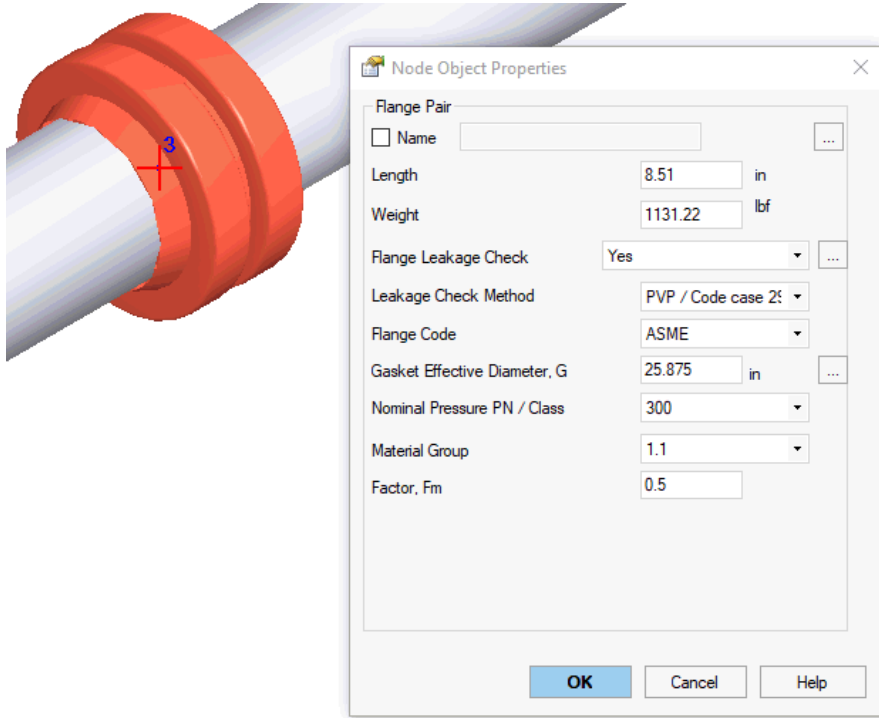
PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE





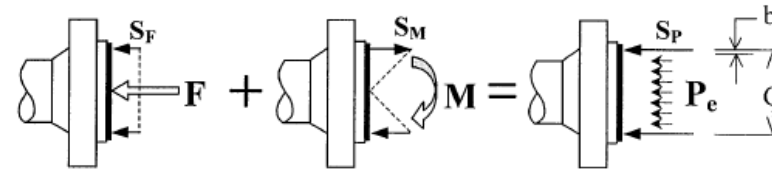
# PASS/Start-Prof | Creación del modelo

## Objeto Flange



Verificación automática de fuga en brida por:

- Presión equivalente / Método Kellogg
- Code Case 2901 / Método PVP2013-97814
- Método DNV
- Método NC 3658.3



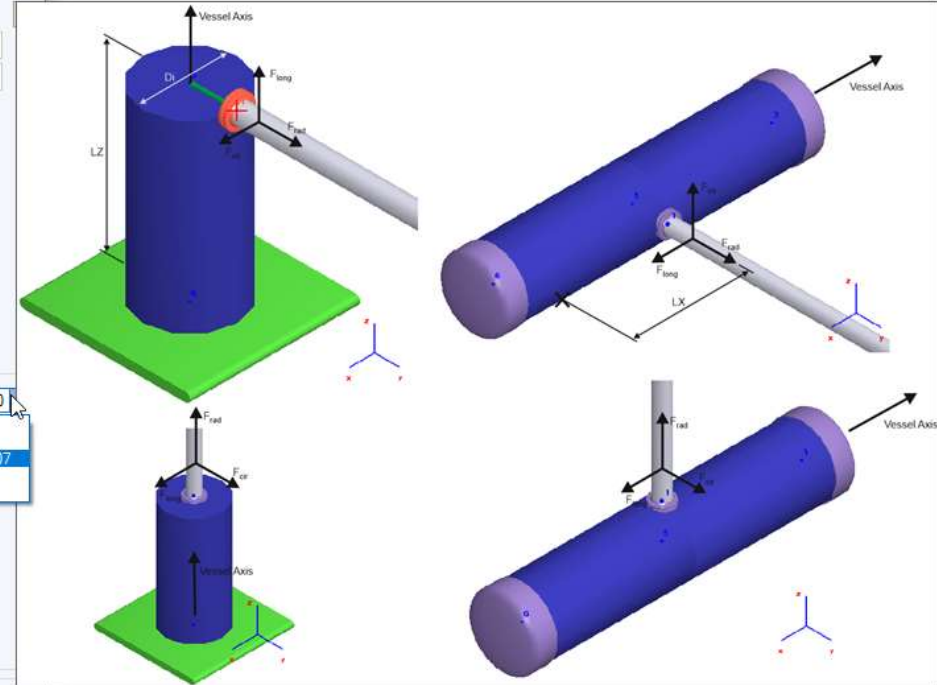
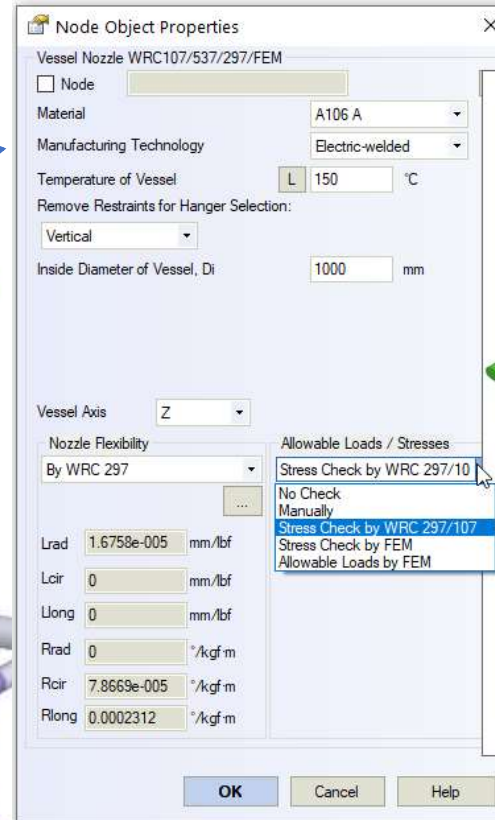
Input Flange leakage

Operating Mode: 1 'Operation mode' (0) Submode: Operation (all loads)

Node Number	Object	Flange on the side of node	Pipe outside diameter, (mm)	Temperature, (°C)	Axial Force, (kgf)	Bending Moment, (kgf-m)	Parameters	Condition, (MPa)			Notes
								calculated	allowable	%	
3	Flange Pair	-	219.08	400	-1000	1499.98	1.60 MPa	4.29 MPa	17.36 MPa	24.70	

# PASS/Start-Prof | Creación del modelo

Objeto Vessel Nozzle

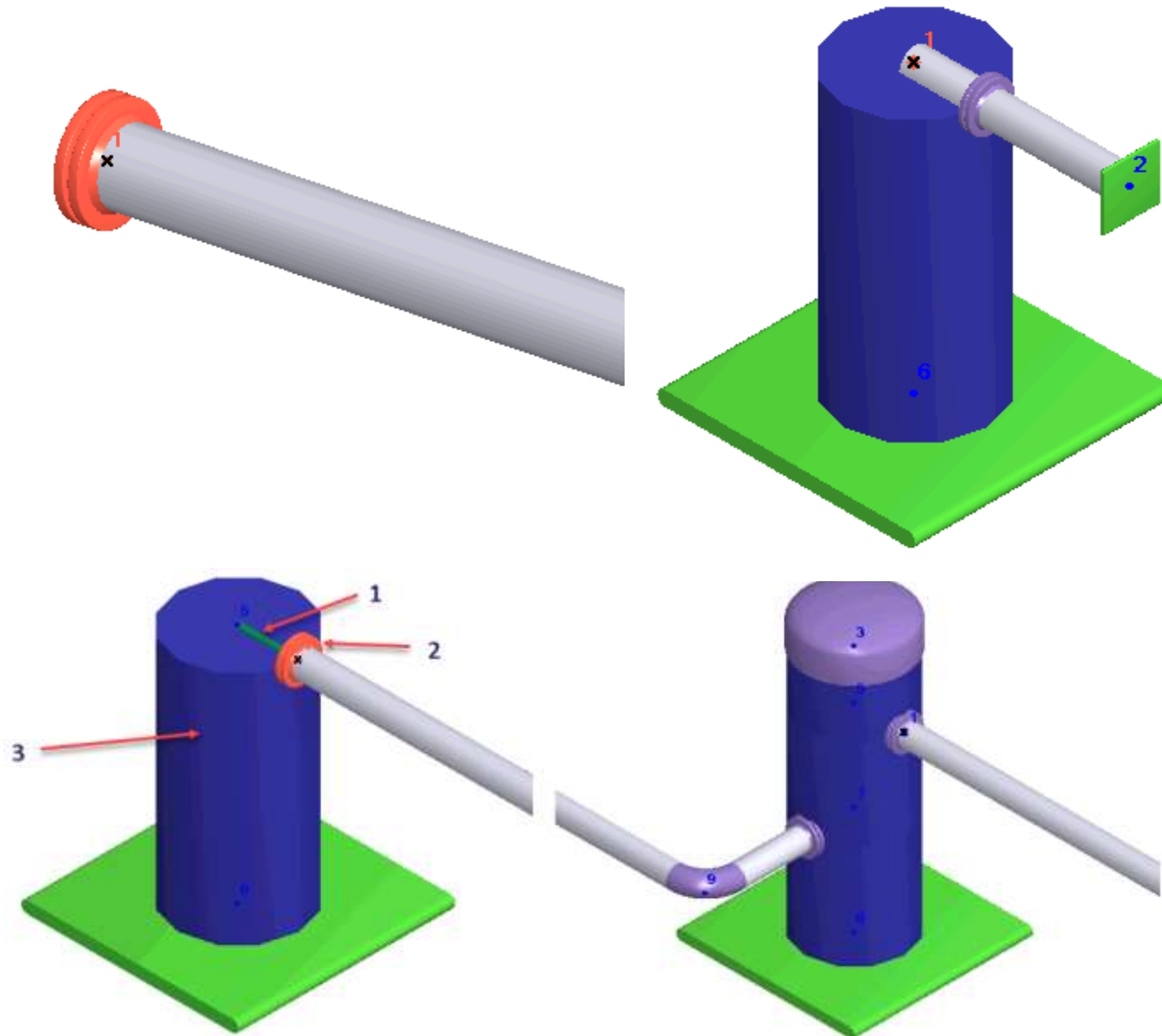


- Calcula Flexibilidad (WRC 297, BS 5500, FEA)
- Verifica cargas permitidas
- Verifica esfuerzos en Boquillas (WRC 537/297, FEA empleando NOZZLE-FEM)



PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Creación del modelo



Equipment

Operating Mode: 1 Padoseal packer (0) | Load Case: Operating W+P+T | Show Equations

Object	Start End node	Type	DN, mm	Prod, kgf	Fci, kgf	Flong, kgf	FR, kgf	Mrad, kgf-cm	Mcic, kgf-cm	Mlong, kgf-cm	MRL, kgf-cm	Sum
Vessel Nozzle WRC107/537/297/FEM	Node (1)	calculated	219	-196.30								0.00
		allowable		58.50								

Nozzle-FEM 3.1.0.0 (c) 2006-2019 by NTP Truboprovod

STRESS ON CYLINDRICAL SHELL AS PER WRC 537(107)  
(In the zone at the nozzle):

Location	AU	AL	BU	BL	CU	CL	DU	DL
Circ. PI-Pb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Circ. PI-Pb-Q	2.9	-1.3	3.1	-1.4	3.9	-2.5	3.9	-2.5
Long. PI-Pb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long. PI-Pb-Q	3.9	-2.5	4.0	-2.0	3.0	-1.3	3.0	-1.3
Shear PI-Pb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shear PI-Pb-Q	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0
PI-Pb (TOTAL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PI-Pb-Q (TOTAL)	3.9	2.5	4.0	2.0	3.9	2.5	3.9	2.5

CONCLUSION:  
Stress Int., Max Sl, Allowable, Result  
MPa, MPa  
PI-Pb (TOTAL), 0.0, 165.5, Passed  
PI-Pb-Q (TOTAL), 4.0, 330.9, Passed

STRESS ON NOZZLE JUNCTION ZONE AS PER WRC 297

Location	AU	AL	BU	BL	CU	CL	DU	DL
Circ. PI-Pb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Circ. PI-Pb-Q	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Long. PI-Pb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Long. PI-Pb-Q	18.5	-17.6	19.2	-18.2	18.8	-17.9	18.8	-17.9
Shear PI-Pb	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shear PI-Pb-Q	-0.1	-0.1	0.1	0.1	0.0	0.0	0.0	0.0
PI-Pb (TOTAL)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PI-Pb-Q (TOTAL)	18.5	18.7	19.2	19.4	18.8	19.0	18.8	19.0

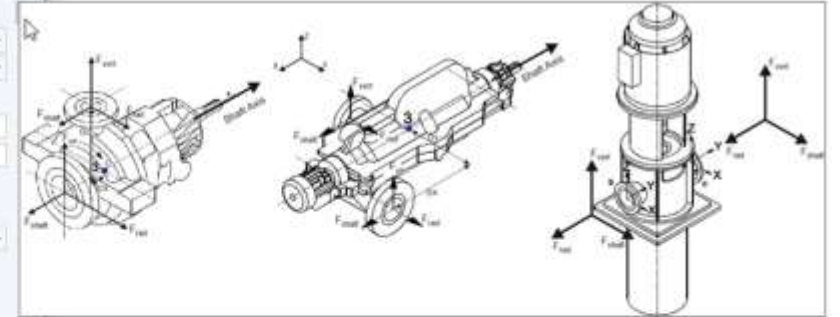
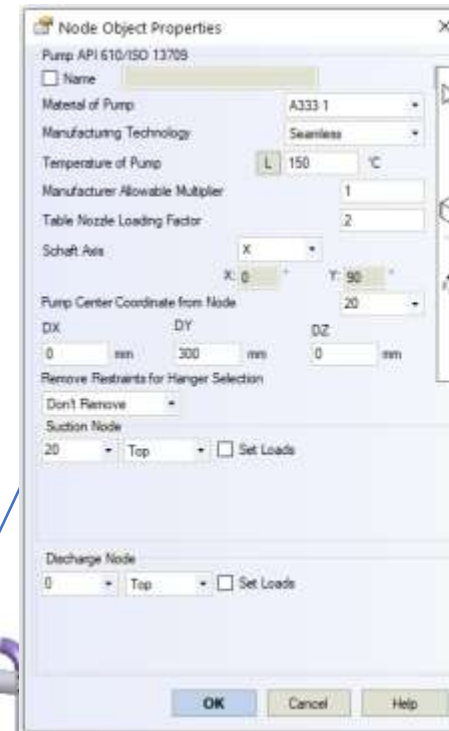
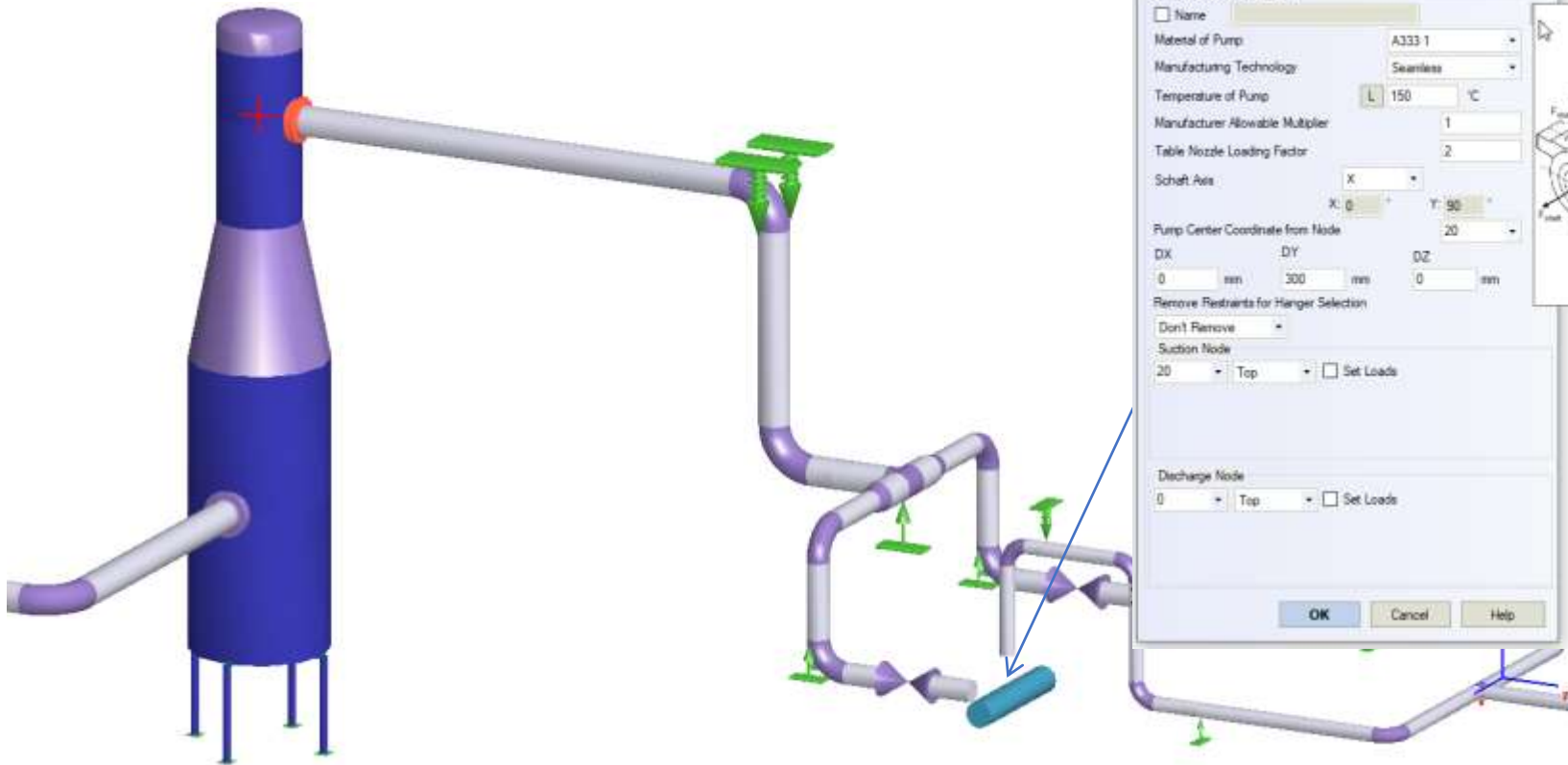
CONCLUSION:  
Stress Int., Max Sl, Allowable, Result  
MPa, MPa  
PI-Pb (TOTAL), 0.0, 165.5, Passed  
PI-Pb-Q (TOTAL), 19.4, 330.9, Passed

RESUME:  
Maximum utilization factor (per): 5.0%  
Strength conditions are satisfied

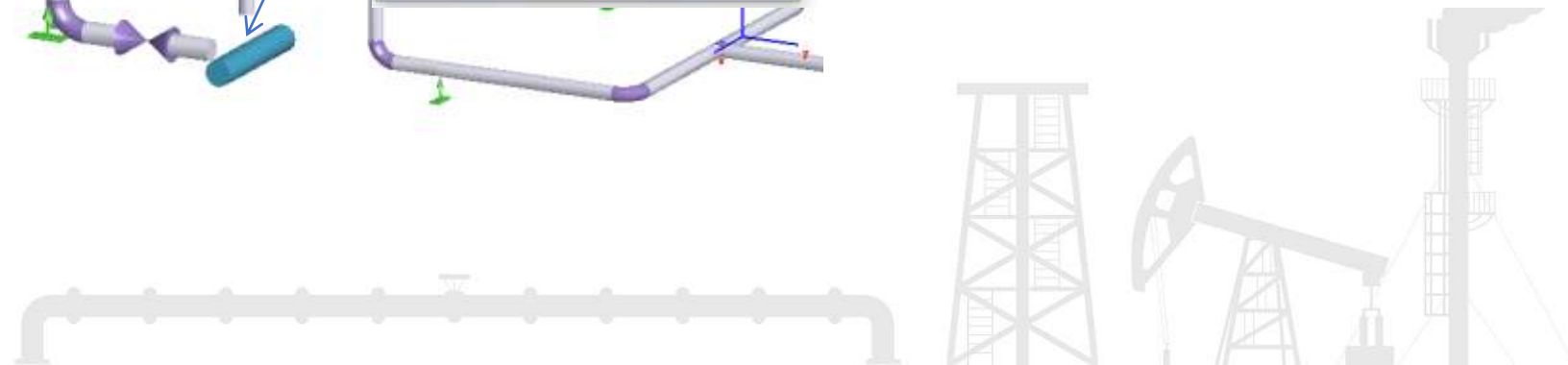
Nozzle-FEM 3.1.0.0 (c) 2006-2019 by NTP Truboprovod

# PASS/Start-Prof | Creación del modelo

## Objeto Pump

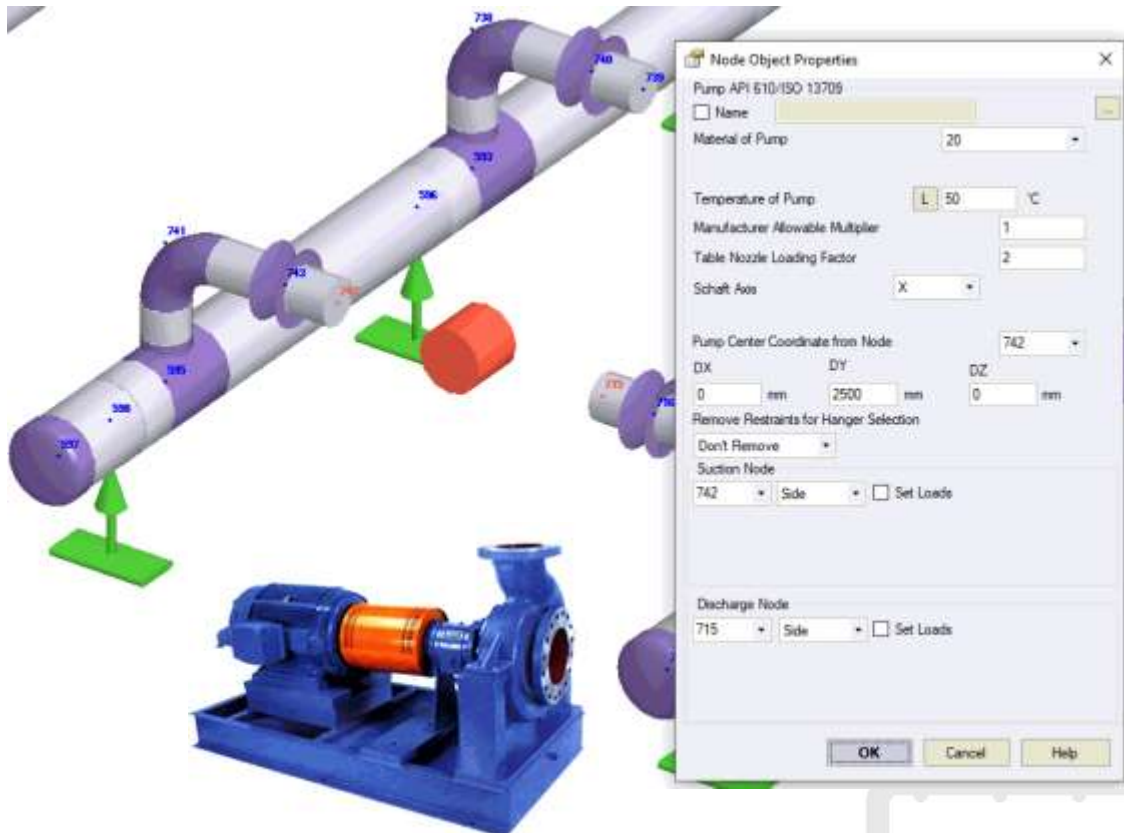


PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE



# PASS/Start-Prof | Creación del modelo

- Objeto "Pump API 610 / ISO 13709", permite modelar automáticamente las bombas, considerar los movimientos térmicos de las boquillas, verificar las cargas permisible utilizando API 610 e ISO 13709
- Objeto "Pump ISO 9905"
- Objeto "Pump ISO 5199"



a) The individual component forces and moments acting on each pump nozzle flange shall not exceed the range specified in Table 5 (T4) by a factor of more than 2.

b) The resultant applied force ( $F_{RSA}$ ,  $F_{RDA}$ ) and the resultant applied moment ( $M_{RSA}$ ,  $M_{RDA}$ ) acting on each pump-nozzle flange shall satisfy the appropriate interaction equations as given in Equations (F.1) and (F.2):

$$|F_{RSA}|(1.5 \times F_{RST4}) + |M_{RSA}|(1.5 \times M_{RST4}) < 2 \quad (F.1)$$

$$|F_{RDA}|(1.5 \times F_{RD14}) + |M_{RDA}|(1.5 \times M_{RD14}) < 2 \quad (F.2)$$

c) The applied component forces and moments acting on each pump nozzle flange shall be translated to the centre of the pump. The magnitude of the resultant applied force,  $F_{RCA}$ , the resultant applied moment,  $M_{RCA}$ , and the applied moment shall be limited by Equations (F.3) to (F.5). (The sign convention shown in Figures 21 through 25 and the right-hand rule should be used in evaluating these equations.)

$$F_{RCA} < 1.5(F_{RST4} + F_{RD14}) \quad (F.3)$$

$$M_{RCA} < 2.0(M_{RST4} + M_{RD14}) \quad (F.4)$$

$$M_{RCA} < 1.5(M_{RST4} + M_{RD14}) \quad (F.5)$$

where

$$F_{RCA} = \sqrt{F_{XCA}^2 + F_{YCA}^2 + F_{ZCA}^2}^{0.5}$$

where

$$F_{XCA} = F_{XSA} + F_{XDA}$$

$$F_{YCA} = F_{YSA} + F_{YDA}$$

$$F_{ZCA} = F_{ZSA} + F_{ZDA}$$

$$M_{RCA} = \sqrt{M_{XCA}^2 + M_{YCA}^2 + M_{ZCA}^2}^{0.5}$$

where

$$M_{XCA} = M_{XSA} + M_{XDA} - [(F_{YSA}(X-S) + F_{YDA}(X-D)) - (F_{ZSA}(Y-S) - (F_{ZDA}(Y-D)))/1\ 000$$

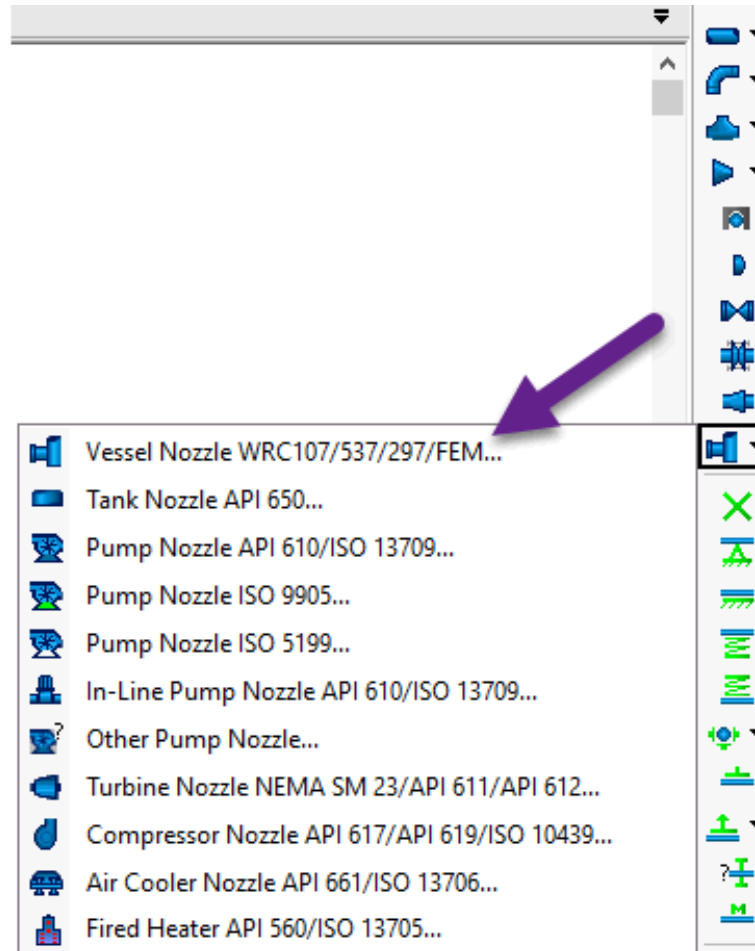
$$M_{YCA} = M_{YSA} + M_{YDA} + [(F_{XSA}(Y-S) + F_{XDA}(Y-D)) - (F_{ZSA}(X-S) - (F_{ZDA}(X-D)))/1\ 000$$

$$M_{ZCA} = M_{ZSA} + M_{ZDA} - [(F_{XSA}(X-S) - (F_{XDA}(X-D)) - (F_{YSA}(Y-S) - (F_{YDA}(Y-D)))/1\ 000$$

Object	Start End node	Type	DN, mm	Frnd, N	Fcir, N	Flong, N	FR, N	Mrad, N-m	Mcir, N-m	Mlong, N-m	MR, N-m	Sum	Notes
Pump API 610/ISO 13709	Node (1)	Suction, Side	200	-7333	5887	-29592	31050	-2626.53	18306.88	4598.20	19057.39	2.84	1
				9780	6220	7560	6920	3520	5160	7060	4710		
	Node (3)	Discharge, Side	200	1440505	-173	0	1440505	0		28.89	28.89	89.39	1
				9780	6220	7560	6920	3520	5160	7060	4710		
		Summary Loads		1433173	5714	-29592	1433490	-2626.53	33102.90	7657.21	34078.35		1
							20760						
$[M_y\_sum] = 2 * [MradT1] + [MradT2] = 2 * (1760 + 1760) = 7040 \text{ N-m}$													

# PASS/Start-Prof | Creación del modelo

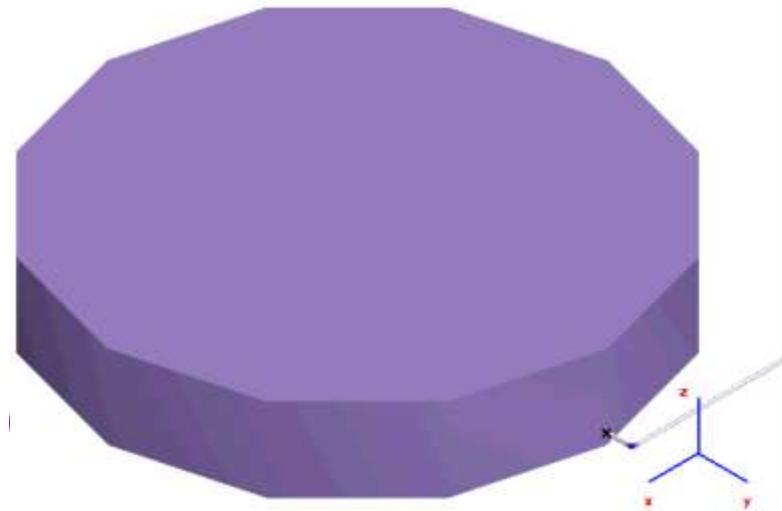
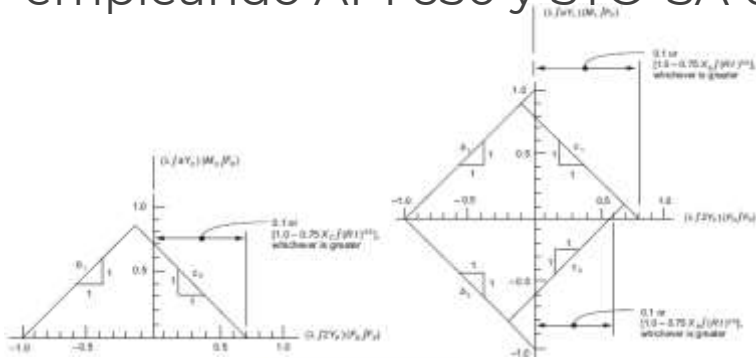
Todos los objetos Equipment para líneas de Proceso y Fuerza



PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Creación del modelo

Objeto "Tank Nozzle API 650", el cual permite modelar automáticamente boquillas en tanques de almacenamiento. Modela automáticamente flexibilidades empleando API 650, movimientos térmicos de la boquilla, movimientos y giros debido al efecto de abultamiento empleando API 650, es capaz de verificar los asentamientos y verificar automáticamente las cargas permisibles empleando API 650 y STO-SA 03-002-2009



Node Object Properties

Tank API 650

Name

Material of Tank: 20

Manufacturing Technology: Seamless

Temperature of Tank: L 40 °C

Remove Restraints for Hanger Selection

Vertical  X  Y  Z  RX  RY  RZ

Radius of Tank, R: 40 m

Length from Bottom to Nozzle Axis, L: 0.63 m

Wall Thickness of Tank, t: 34 mm

Outer Diameter of Nozzle, 2a: 610 mm

Reinforcement: On Shell

Filling Height, H: L 5 m

Density of Product, G: 1000 kg/m<sup>3</sup>

Settlement of Tank, e: L 200 mm

Nozzle Flexibility

By API 650

Allowable Loads

By API 650

Lred 0.3042880744 mm/f

Lcr 0 mm/f

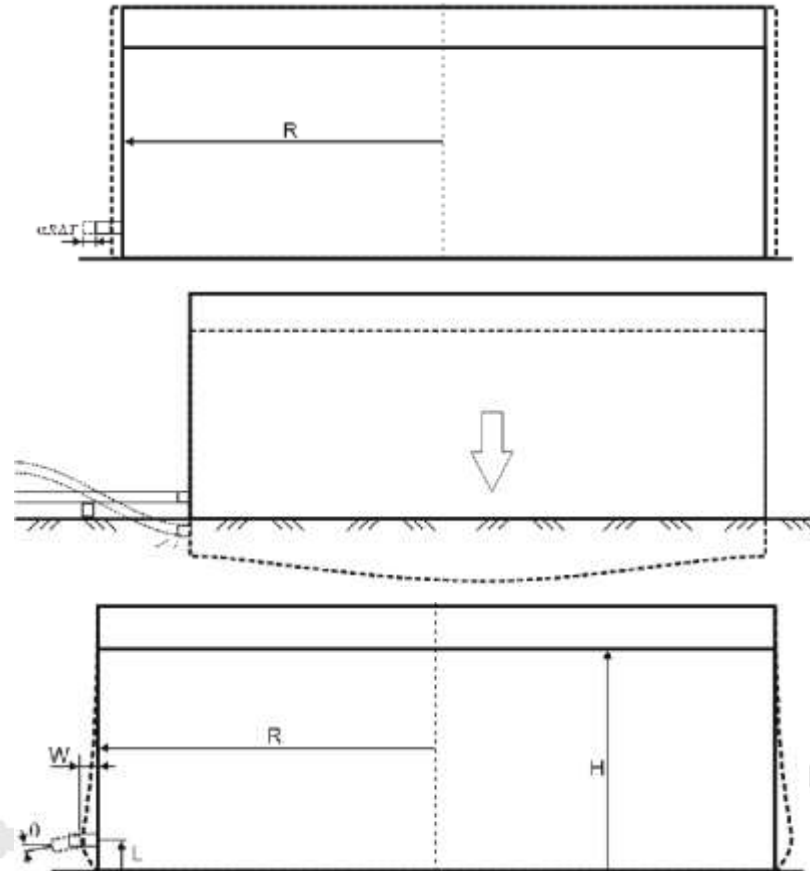
Llong 0 mm/f

Rrad 0 rad./f m

Rcr 0.00039594 rad./f m

Rlong 0.00062095 rad./f m

OK Cancel Help



# PASS/Start-Prof | Creación del modelo

Con el Objeto "In-line Pump", modele automáticamente bombas verticales en línea, considera los movimientos térmicos de las Boquillas, verifica cargas permisibles de acuerdo con API 610 e SO 13709.

**Node Object Properties**

In-Line Pump API 610/ISO 13709

Code: API 610

Length: 400 m      Weight: 50 N

Material of Pump: 20

Manufacturing Technology: Seamless

Temperature of Pump: L 100 °C

Factor for Temperature: 1

Nozzle Loading Factor: 2

Pump Center of Gravity Coordinate from Node: 3

DX: 0 mm      DY: 500 mm      DZ: 0 mm

Suction Node: 1

Discharge Node: 2

OK      Cancel      Help



For SI units, Equations (F.6) to (F.8) apply:

$$\sigma_p = (\sigma/2) + (\sigma^2/4 + r^2)^{0.5} < 41 \quad (F.6)$$

$$\alpha_1 = [1,27F_y/(D_o^2 - D_i^2)] + [10\,200D_o(M_x^2 + M_z^2)^{0.5}]/(D_o^4 - D_i^4) \quad (F.7)$$

$$r = [1,27(F_x^2 + F_z^2)^{0.5}]/(D_o^2 - D_i^2) + [5\,100D_o(M_y)]/(D_o^4 - D_i^4) \quad (F.8)$$

For USC units, Equations (F.9) to (F.11) apply:

$$\sigma_p = (\sigma/2) + (\sigma^2/4 + r^2)^{0.5} < 5\,950 \quad (F.9)$$

$$\alpha_1 = [1,27F_y/(D_o^2 - D_i^2)] + [122D_o(M_x^2 + M_z^2)^{0.5}]/(D_o^4 - D_i^4) \quad (F.10)$$

$$r = [1,27(F_x^2 + F_z^2)^{0.5}]/(D_o^2 - D_i^2) + [61D_o(M_y)]/(D_o^4 - D_i^4) \quad (F.11)$$

where

- $\sigma_p$  is the principal stress, expressed in megapascals (pounds-force per square inch);
- $\alpha_1$  is the longitudinal stress, expressed in megapascals (pounds-force per square inch);
- $r$  is the shear stress, expressed in megapascals (pounds-force per square inch);
- $F_x$  is the applied force on the X axis;
- $F_y$  is the applied force on the Y axis;
- $F_z$  is the applied force on the Z axis;

Input      Equipment

Operating Mode: 1 'main mode' (0)      Load Case: Operating W+P+T       Show Equations      ?

Object	Start End node	Type	DN, mm	Frad, N	Fcir, N	Flong, N	FR, N	Mrad, N·m	Mcir, N·m	Mlong, N·m	MR, N·m	Sum	Notes
In-Line Pump API 610/ISO 13709	Node (1)	Suction, Side	219	-1200421		-28			47.98			0.00	1
				7560	9780	6220		7060	3520	5160			
	Node (2)	Discharge, Side	219	-1200421		-27			47.98			0.00	1
					7560	9780	6220		7060	3520	5160		



# PASS/Start-Prof | Creación del modelo

El objeto "Compressor API 617/API 619/ISO 10439", permite modelar automáticamente compresores, considera los movimientos térmicos de la boquillas, verifica cargas permisibles empleando API 617 e ISO 10439

**Node Object Properties**

Compressor API 617/ISO 10439

Name

Material of Compressor: 20

Manufacturing Technology: Seamless

Temperature of Compressor: L 100 °C

Factor for Allowable Loads: 1

Shaft Axis: X

Center of Compressor Coordinate from Node: 3

DX 0 mm DY 500 mm DZ 0 mm

Remove Restraints for Hanger Selection: Don't Remove

Suction Nozzle: 1  Set Manual Loads

Discharge Node: 3  Set Manual Loads

Additional Nozzle 1: 0  Set Manual Loads

Additional Nozzle 2: 0  Set Manual Loads

OK Cancel Help

In SI units:

$$F_r + 1.09 M_r \leq 54.1 D_s \quad (F.1a)$$

In U.S. customary (USC) units:

$$3 F_r + M_r \leq 927 D_s \quad (F.1b)$$

$F_r$  is the resultant force, Newtons (lb) (see Figure F.1);

$$F_r = \sqrt{F_x^2 + F_y^2 + F_z^2} \quad (F.2)$$

$M_r$  resultant moment, in Newton-meters (ft-lb) from Figure F.1;

$$M_r = \sqrt{M_x^2 + M_y^2 + M_z^2} \quad (F.3)$$

For sizes greater than 200 mm (8 in.), use the following values.

In SI units:

$$D_s = \frac{(400 + D_{mm})}{3} \quad (\text{mm}) \quad (F.4a)$$

In USC units:

$$D_s = \frac{(16 + D_{in})}{3} \quad (\text{in.}) \quad (F.4b)$$

In SI units:

$$F_r + 1.64 M_r \leq 40.4 D_s \quad (F.5a)$$

In USC units:

$$2 F_r + M_r \leq 462 D_s \quad (F.5b)$$



In SI units:

$$F_r + 1.64 M_r \leq 40.4 D_s \quad (F.5a)$$

In USC units:

$$2 F_r + M_r \leq 462 D_s \quad (F.5b)$$

where

$F_r$  is the combined resultant of inlet, sidestream, and discharge forces, Newtons (lb);

$M_r$  is the combined resultant of inlet, sidestream, and discharge moments, and moments resulting from forces, Newton-meters (ft-lb);

$D_s$  is the diameter [mm (in.)] of one circular opening equal to the total areas of the inlet, sidestream, and discharge openings. If the equivalent nozzle diameter is greater than 230 mm (9 in.), use a value of  $D_s$  equal to the following.

In SI units:

$$D_s = \frac{(460 + \text{Equivalent Diameter})}{3} \quad (\text{mm}) \quad (F.5a)$$

In USC units:

$$D_s = \frac{(18 + \text{Equivalent Diameter})}{3} \quad (\text{in.}) \quad (F.5b)$$

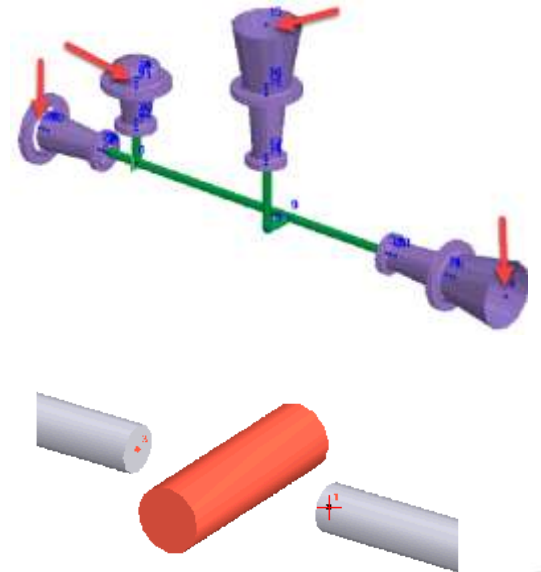
The absolute value of the individual components (Figure F.1) of these resultants should not exceed the following.

In SI units:

$$F_x = 16.1 D_s \quad M_x = 24.6 D_s \quad (F.5a)$$

$$F_y = 40.5 D_s \quad M_y = 12.1 D_s \quad (F.5a)$$

$$F_z = 32.4 D_s \quad M_z = 12.1 D_s \quad (F.5b)$$



Input Equipment

Opening Mode: 1 Рабочий режим (R) Load Case: Operating W+P+T

Show Equations

Object	Start End node	Type	DN, mm	Frad, N	Fcis, N	Flong, N	FR, N	Mrad, N-m	Mcir, N-m	Mlong, N-m	MR, N-m	Sum	Notes
Compressor API 617/API 619/ISO 10439	Node (1)	Suction, Top	200	-15918	12907	-23209	30962	-2577.83	11010.28	8677.81	14253.98	4.30	1
	Node (3)	Discharge, Top	200	1440505	-173	0	1440505	0		28.89	28.89	133.14	1
	ext1												
	ext2												
Summary Loads:			250.91	1424587	12734	-23209	1424833	-2577.83	22615.01	15246.83	27396.16	144.99	
			8130	Dc=250.9141 mm					86.24	6172.48			
				[Fcr]=k1*40.3Dc=1.00*10162.02=10162.02 N									

# PASS/Start-Prof | Creación del modelo

El objeto "Turbine NEMA SM23/API 611/API 612", permite modelar automáticamente turbinas de vapor, considera movimientos térmicos de las boquillas, verifica cargas permisibles empleando NEMA SM23, API 611, API 612, ISO 10437

Node Object Properties

Turbine NEMA SM 23

Name

Material of Compressor: 20

Manufacturing Technology: Seamless

Temperature of Compressor: L 100 °C

Factor for Allowable Loads: 1

Shaft Axis: X

Center of Compressor Coordinate from Node: 3

DX 0 mm DY 500 mm DZ 0 mm

Remove Restraints for Hanger Selection: Don't Remove

Suction Nozzle: 1  Set Manual Loads

Discharge Node: 3  Set Manual Loads

Additional Nozzle 1: 0  Set Manual Loads

Additional Nozzle 2: 0  Set Manual Loads

OK Cancel Help



PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE



# PASS/Start-Prof | Creación del modelo

El objeto "Other Pump", permite modelar automáticamente bombas, considera movimientos térmicos de las boquillas, verifica cargas permisibles

Node Object Properties

Other Pump

Name

Material of Pump: 20

Manufacturing Technology: Seamless

Temperature of Pump: L 100 °C

Shaft Axis: X X: 0 ° Y: 90 °

Pump Center Coordinates from Node: 3

DX: 0 mm DY: 500 mm DZ: 0 mm

Remove Restraints for Hanger Selection

Vertical  X  Y  Z  RX  RY  RZ

Suction Node

3	FR	MR			
	N	N-m			
	<input type="text" value="1"/>	<input type="text" value="1"/>			
FX	FY	FZ	MX	MY	MZ
N	N	N	N-m	N-m	N-m
<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>

Discharge Node

1	FR	MR			
	N	N-m			
	<input type="text" value="1"/>	<input type="text" value="1"/>			
FX	FY	FZ	MX	MY	MZ
N	N	N	N-m	N-m	N-m
<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>

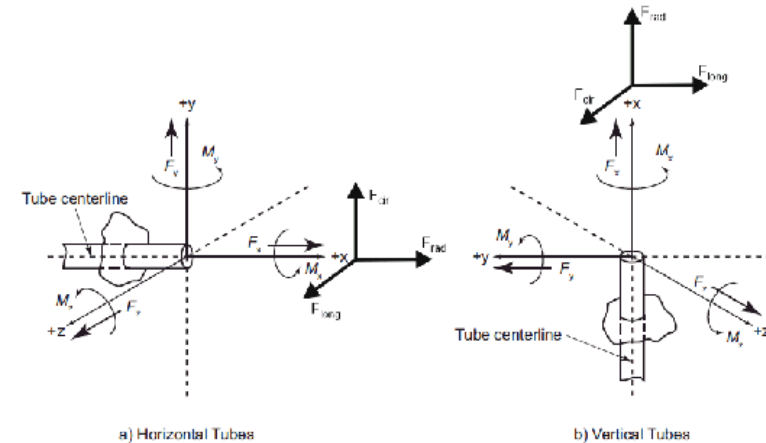
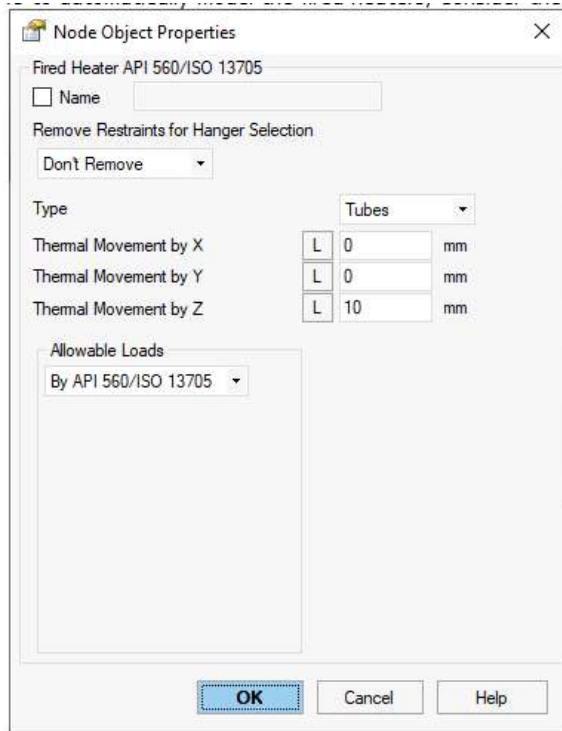
OK Cancel Help



PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Creación del modelo

El objeto "Fired Heater API 560/ISO 13705", permite modelar automáticamente calentadores a fuego directo, considera movimientos en las boquillas, verifica cargas permisibles empleando API 560 e ISO 13705



displayed. In the second row the allowable values are displayed.

Object	Start End node	Type	DN, mm	Frad, kgf	Fcir, kgf	Flong, kgf	FR, kgf	Mrad, kgf-cm	Mcir, kgf-cm	Mlong, kgf-cm	MR, kgf-cm	Sum	Notes
Fired Heater API 560/ISO 13705	Node (1)	calculated	219	-96033.70		40605.70			-2029708.86				1
		allowable		133.40	266.90	266.90		11660	8810	8810			

# PASS/Start-Prof | Creación del modelo

El objeto "Air cooled Heat Exchanger API 661/ISO 13706", permite modelar automáticamente aero enfriadores, considera movimientos térmicos de la boquillas, verifica cargas permisibles empleando API 661 e ISO 13706

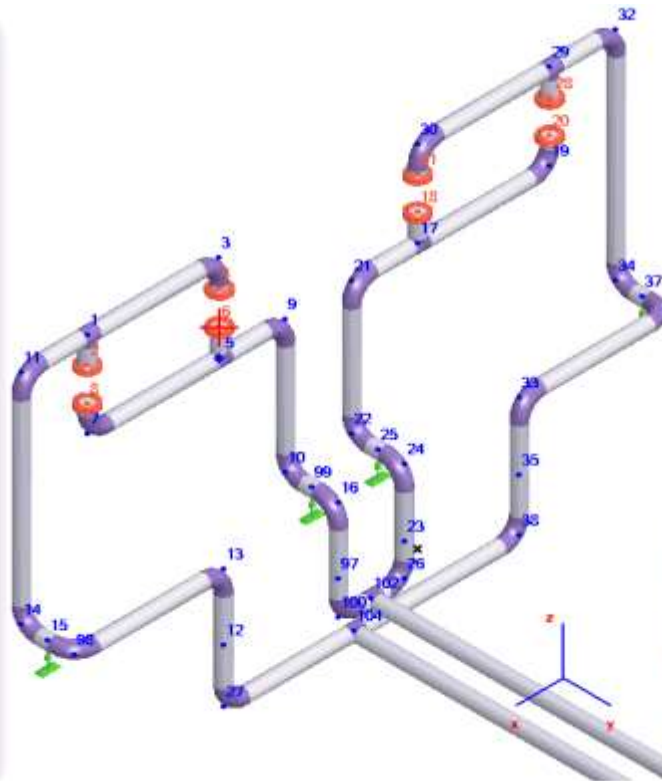
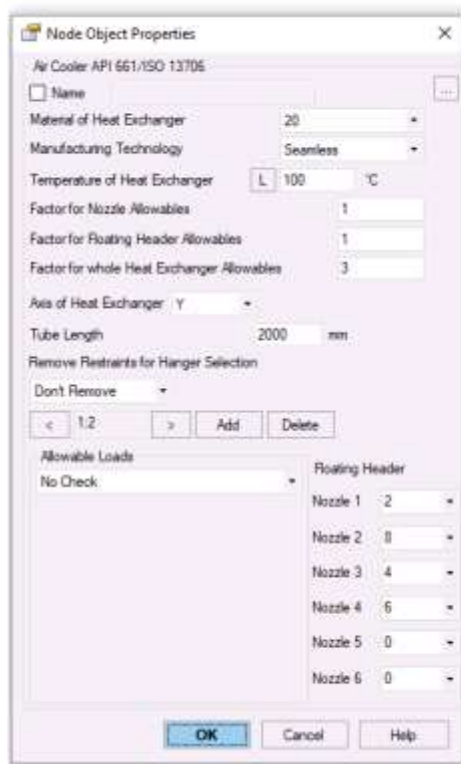


Table 4 — Maximum Allowable Nozzle Loads

Nozzle Size DN (NPS)	Moments N·m (ft·lbf)			Forces N (lbf)		
	$M_x$	$M_y$	$M_z$	$F_x$	$F_y$	$F_z$
40 (1½)	110 (80)	150 (110)	110 (80)	670 (150)	1020 (230)	670 (150)
50 (2)	150 (110)	240 (180)	150 (110)	1020 (230)	1330 (300)	1020 (230)
80 (3)	410 (300)	610 (450)	410 (300)	2000 (450)	1690 (380)	2000 (450)
100 (4)	610 (600)	1220 (900)	610 (600)	3340 (750)	2670 (600)	3340 (750)
150 (6)	2140 (1580)	3050 (2250)	1630 (1200)	4000 (900)	5030 (1130)	5030 (1130)
200 (8)	3050 (2250)	6100 (4500)	2240 (1650)	5690 (1280)	13,340 (3000)	8010 (1800)
250 (10)	4070 (3000)	6100 (4500)	2950 (1880)	6670 (1500)	13,340 (3000)	10,010 (2250)
300 (12)	5000 (3750)	6100 (4500)	3050 (2250)	8360 (1880)	13,340 (3000)	13,340 (3000)
350 (14)	6100 (4500)	7120 (5250)	3570 (2630)	10,010 (2250)	16,680 (3750)	16,680 (3750)

Values from 7.1.10.2

7.1.10.2 The design of each fixed or floating header, the design of the connections of fixed headers to side frames, and the design of other support members shall ensure that the simultaneous application (sum) of all nozzle loadings on a single header does not cause any damage. The components of the nozzle loadings on a single header shall not exceed the following values:

- $M_x$  6100 N·m (4500 ft·lbf)
- $M_y$  6130 N·m (6000 ft·lbf)
- $M_z$  4070 N·m (3000 ft·lbf)
- $F_x$  10,010 N (2250 lbf)
- $F_y$  20,020 (4500 lbf)
- $F_z$  16,680 (3750 lbf)

Values from 7.1.10.2 multiplied by 3

7.1.10.3 The total of all nozzle loads on one multi-bundle bay shall not exceed three times that allowed for a single header.



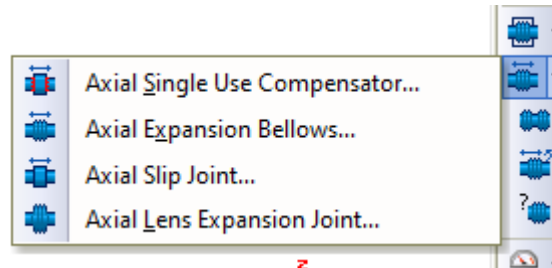
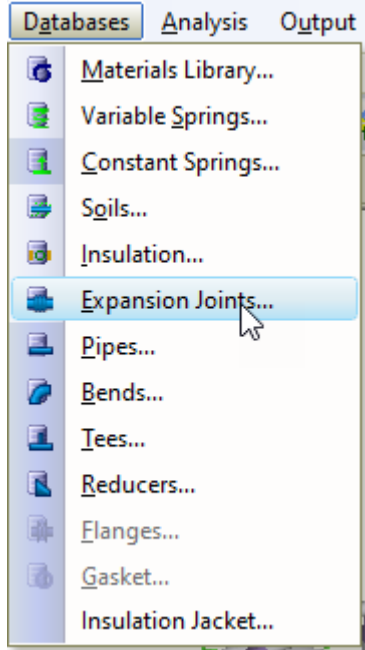
PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE



# PASS/Start-Prof | Creación del modelo

Objetos junta de expansion + Base de datos

PASS/START-PROF incluye varios tipos de junta de expansion y base de datos. Se verifica automáticamente las deformaciones de la junta de expansión

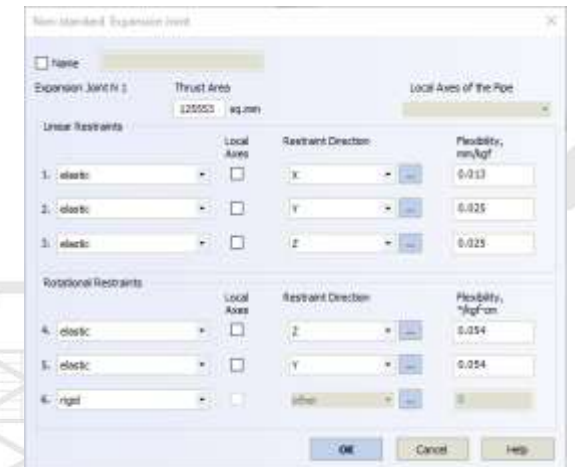
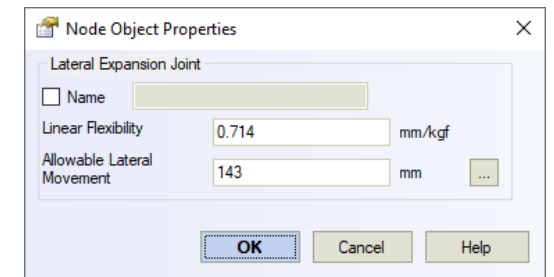
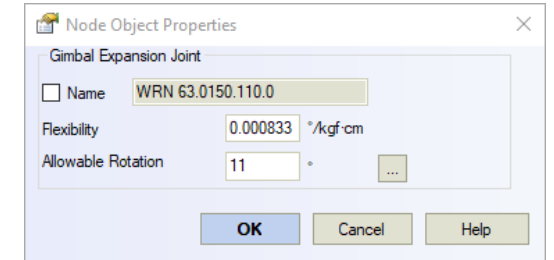


Expansion Joints

Type: Rotation expansion joint

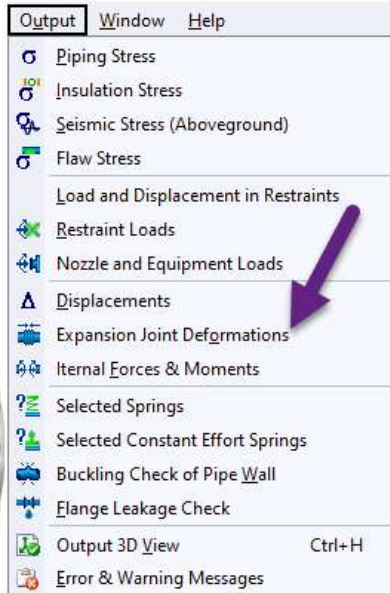
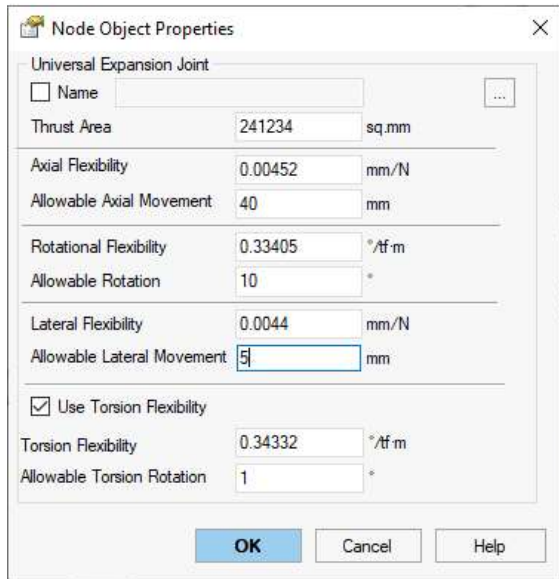
Type	Supplier	Code	Description	Nominal Diameter mm	Friction Moment, N-m	Flexibility %/N-m	Thrust / sq.m
Gimbal expansion joint	Witzenmann	TU 3695-006-15294711	WBK 10.0200.320.0	200	0	0.04	0
Gimbal expansion joint	Witzenmann	TU 3695-006-15294711	WBK 16.0200.220.0	200	0	0.018182	0
Gimbal expansion joint	Witzenmann	TU 3695-006-15294711	WBK 16.0200.310.0	200	0	0.029412	0
Gimbal expansion joint	Witzenmann	TU 3695-006-15294711	WBK 25.0200.140.0	200	0	0.012821	0
Gimbal expansion joint	Witzenmann	TU 3695-006-15294711	WBK 25.0200.220.0	200	0	0.018182	0
Gimbal expansion joint	Witzenmann	TU 3695-006-15294711	WBN 06.0200.230.0	200	0	0.052632	0
Gimbal expansion joint	Witzenmann	TU 3695-006-15294711	WBN 10.0200.220.0	200	0	0.030303	0
Gimbal expansion joint	Witzenmann	TU 3695-006-15294711	WBN 10.0200.320.0	200	0	0.04	0
Gimbal expansion joint	Witzenmann	TU 3695-006-15294711	WBN 16.0200.220.0	200	0	0.018182	0

Buttons: Add, Delete, Import, Save, Close, Help



# PASS/Start-Prof | Creación del modelo

El objeto "Untied Expansion Joint" y base de datos de Juntas de Expansion sin tirantes, lo que permite especificar flexibilidad axial, rotacional, cortante y torsión también verifica automáticamente las deformaciones tanto individuales como combinadas. No necesita más modelar manualmente empleando junta de expansión no-estándar.



$$\frac{|\lambda_p|}{[\lambda_p]} + \frac{|\lambda_\theta|}{[\lambda_\theta]} + \frac{|\lambda_\Delta|}{[\lambda_\Delta]} \leq 1.$$

Node Number	Type	Local axis	Axial, (mm)	Allowable, (mm)	Shear, (mm)	Allowable, (mm)	Angular, (°)	Allowable, (°)	Torsion, (°)	Allowable, (°)	Summary	Notes
12	Untied Expansion Joint	Pipe 3 - 12	2,41	50	1,22	15	9,59131	10	-2,05119	No	1,09	1
13	Torsion Expansion Joint	Pipe 5 - 13	0	No	0	No	0	No	13,9229	51,5662	0,27	
15	Torsion Expansion Joint	Pipe 7 - 15	0	No	0	No	0	No	10,1299	51,5662	0,20	
21	Torsion Expansion Joint	Pipe 19 - 21	0	No	0	No	0	No	-4,36021	51,5662	0,08	



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# PASS/Start-Prof | Creación del modelo

- Objeto "Torsion Expansion Joint" y base de datos de torsión en juntas de expansión, el cual modela automáticamente la fricción por torsión (momento de torsión) y verifica el ángulo permisible de rotación.
- Objeto "Slip Joint" y base de datos de juntas de deslizamiento, el cual modela automáticamente la fricción axial y verifican la deformación permitida.

Node Object Properties

Torsion Expansion Joint

Name

Friction Moment 0 kgf·cm

Allowable Rotation 0

OK Cancel Help

Node Object Properties

Slip Joint

Name

Friction Force 0 kgf

Allowable Axial Expansion 0 mm

Pressure Balanced

OK Cancel Help

Angular Torsion...



# PASS/Start-Prof | Creación del modelo

Objetos “Plane flaw” y “Volumetric flaw” para cálculos si el elemento es apto-para-servicio

The image displays the PASS software interface for creating a model. On the left, the "Node Object Properties" dialog box is open, showing settings for a "Volumetric Flaw". The "Flaw Type" is set to "Inner". Parameters include: Half Of Axial Length (A) = 0 mm, Circumferential Half Length Of Defect (B) = 0 mm, Measured Depth with Corosion Allowance (C) = 0 mm, Measured Wall Thickness nearby Flaw (T) = 0 mm, and Tensile strength at Operating Temperature, cb = 0 kgf/sq. The dialog also features "OK", "Cancel", and "Help" buttons.

In the center, a technical diagram illustrates a pipe with a flaw. It shows a longitudinal section with dimensions  $2A$ ,  $2B$ , and  $2C$ , and a cross-section with dimensions  $2a$  and  $2b$ . A coordinate system with  $x$ ,  $y$ , and  $z$  axes is shown.

On the right, a menu is open, listing various analysis types. The "Flaw Stress" option is highlighted. Other options include: Piping Stress, Insulation Stress, Seismic Stress (Aboveground), MDMT, Impact Test, Load and Displacement in Restraints, Restraint Loads, Nozzle and Equipment Loads, Displacements, Expansion Joint Deformations, Internal Forces & Moments, Selected Springs, Selected Constant Effort Springs, Buckling Check of Pipe Wall, Flange Leakage Check, Output 3D View (Ctrl+H), and Error & Warning Messages.

At the bottom left, the PASS logo is displayed, along with the text "PIPING AND EQUIPMENT ANALYSIS & SIZING SUITE".

On the right side, there is a photograph of a pipe with a dark, irregularly shaped defect on its surface. Below the photograph are two technical diagrams: one showing a cross-section of a pipe with a flaw and dimensions  $2r$ ,  $2\theta$ , and  $r$ ; the other showing a longitudinal section with dimensions  $2\theta$  and  $C$ .



PIPING AND EQUIPMENT  
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# PASS/Start-Prof | Base de datos de materiales

Bases de datos de materiales para cada código.

## ASME B31.3

- Contiene datos para cálculo de Creep Rupture Factor calculation, y esfuerzos alternativos ocasionales
- Calculos para temperature mínima para diseño
- Contien un “flag” para usar  $f=1.2$  o  $f=1.0$

(d) Allowable Displacement Stress Range,  $S_A$ . The computed displacement stress range,  $S_E$ , in a piping system [see para. 319.4.4] shall not exceed the allowable displacement stress range,  $S_A$  [see paras. 319.2.3 and 319.3.4], calculated by eq. (1a)

$$S_A = f(1.25S_c + 0.25S_h) \quad (1a)$$

When  $S_h$  is greater than  $S_L$ , the difference between them may be added to the term  $0.25S_h$  in eq. (1a). In that case, the allowable stress range is calculated by eq. (1b)

$$S_A = f[1.25(S_c + S_h) - S_L] \quad (1b)$$

For eqs. (1a) and (1b)

$f$  = stress range factor, <sup>3</sup> calculated by eq. (1c)<sup>‡</sup>

$$f \text{ (see Fig. 302.3.5)} = 6.0(N)^{-0.2} \leq f_m \quad (1c)$$

$f_m$  = maximum value of stress range factor: 1.2 for ferrous materials with specified minimum tensile strengths  $\leq 517$  MPa (75 ksi) and at metal temperatures  $\leq 371^\circ\text{C}$  ( $700^\circ\text{F}$ ); otherwise  $f_m = 1.0$

Material: A182 F310 Class: Austenitic Steel

Database can only be edited if database files are open for editing and if stress units are set as MPa (for ASME - ksi)

Data source: ASME B31.3-2018 Austenitic

Density: 8027.172363 kg/m3

Larson-Miller constant C: 15

Min. Temperature: -325 F

Creep Factors: Austenitic Steel

Maximum f=1.2

Mn. Temperature: [dropdown]

Temperature F	Allowable Stress (S), ksi	Yield Stress (Sy), ksi	Elastic Modulus ksi	Expansion Coeff. 1/F	Poisson's Ratio (v)	WI
800.006	17.400	19.400	24100	9.4e-006	0.292	1.0
849.992	17.200	19.100	23800	9.45e-006	0.292	1.0
899.996	16.900	18.800	23499.999	9.5e-006	0.292	1.0
950	15.900	18.500	23150	9.55e-006	0.292	1.0
1000.004	9.900	18.200	22799.999	9.6e-006	0.292	0.95
1050.008	7.100	0	22400	9.65e-006	0.292	0.91
1099.994	5	0	22000	9.7e-006	0.292	0.86
1149.998	3.600	0	21600.001	9.75e-006	0.292	0.82
1200.002	2.500	0	21200	9.8e-006	0.292	0.77
1250.006	1.500	0	20750	9.85e-006	0.292	0.73

Buttons: Add, Delete, Print, Export..., Save, OK, Cancel, Help

# PASS/Start-Prof | Base de datos de materiales

Bases de datos de materiales para cada código.

Por ejemplo base de datos EN 13480/EN 13941

- Puede seleccionar automáticamente materiales del material dependiendo del espesor de pared y si opción sin costura/soldable
- Contiene propiedades para creep analysis

Material: 1.0345/P235GH Class: Carbon or Low Alloy Steel

Database can only be edited if database files are open for editing and if stress units are set as MPa (for ASME - ksi)

Data source: EN 10216-2-2013

Density: 7850 kg/m<sup>3</sup>

Factor A, %: 23

Th, cm	Yield Stress (Rp), ksi	Tensile Strength (Rm), ksi
1.6	34.084	52.214
4	32.633	52.214
6	31.183	52.214

Temperature F	Yield Stress (Rp), ksi	Tensile Strength (Rm), ksi	Elastic Modulus ksi	Expansion Coeff. 1/F	Poisson's Ratio (ν)	SRTt 10 000 h, ksi	SRTt 100 000 h, ksi	SRTt 200 000 h, ksi	SRTt 250 000 h, ksi
68	0	0	30714.787	6.277e-006	0.3	0	0	0	0
212	28.717	52.214	29887.637	6.611e-006	0.3	0	0	0	0
302	27.122	52.214	29353.463	6.804e-006	0.3	0	0	0	0
392	24.656	52.214	28805.946	6.986e-006	0.3	0	0	0	0
482	21.756	52.214	28245.375	7.155e-006	0.3	0	0	0	0
572	19.145	52.214	27671.460	7.313e-006	0.3	0	0	0	0
662	17.405	52.214	27084.493	7.458e-006	0.3	0	0	0	0
752	16.244	52.214	26484.181	7.592e-006	0.3	26.397	20.450	18.565	17.695
770	16.128	52.214	26362.495	7.617e-006	0.3	24.076	18.565	16.679	15.809
788	16.012	52.214	26240.228	7.642e-006	0.3	21.901	16.534	14.794	14.069
806	15.896	52.214	26117.526	7.667e-006	0.3	20.015	14.504	12.908	12.473
824	15.780	52.214	25994.389	7.691e-006	0.3	18.130	12.763	11.168	10.733
842	15.664	52.214	25870.527	7.714e-006	0.3	16.244	11.168	9.572	9.282



PIPING AND EQUIPMENT ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Base de datos de materiales

Bases de datos de materiales para cada código.

Base de datos ISO 14692

- Contiene factor  $f_c$
- Contiene factor  $G_{xx}$
- Y todo para ejecutar un análisis profesional exacto, solicite al fabricante los datos para esta tabla

Material: Wavistrong 55 Class: FRP

Database can only be edited if database files are open for editing and if stress units are set as MPa (for ASME - ksi)

Data source: Data provided by Future Pipe Industries

Density: 1850 kg/m<sup>3</sup>

Cyclic long term strength factor,  $f_c$ : 4

Temperature F	al(0:1), ksi	al(1:1), ksi	hl(1:1), ksi	al(2:1), ksi	hl(2:1), ksi	$q_s$ bend, reducer, ksi	$q_s$ tee, nozzle, ksi	$E_s$ , ksi	$E_h$ , ksi	G, ksi	Expansion Coeff. 1/F	Poisson factor Vh/a	$G_{xx}$
68	4.714	0	0	9.065	18.130	11.603	9.282	1522.896	2973.274	1667.934	0.0000111111	0.65	0.045
104	4.714	0	0	9.065	18.130	11.603	9.282	1416.294	2824.610	1584.537	0.0000111111	0.65	0.054
140	4.714	0	0	9.065	18.130	11.603	9.282	1324.920	2675.946	1501.141	0.0000111111	0.65	0.063
149	4.714	0	0	9.065	18.130	11.603	9.282	1328.691	2623.878	1471.988	0.0000111111	0.65	0.065
176	4.250	0	0	8.166	16.317	10.443	8.354	1340.149	2467.817	1384.385	0.0000111111	0.65	0.078

Materials Selection Window:

Select Material

Code: ISO 14692 (GRP piping systems, International)

Manufacturing method: [Empty]

Material: Wavistrong 55

Materials List:

- Bondstrand 2000
- Bondstrand 55
- Bondstrand 7000
- Fiberbond 20FR20-20year
- Fiberbond 20FR20-25year
- Fiberbond 20FR20-30year
- Fiberbond 20FR20-50year
- Saplast 55
- Wavistrong 55
- Wavistrong 63

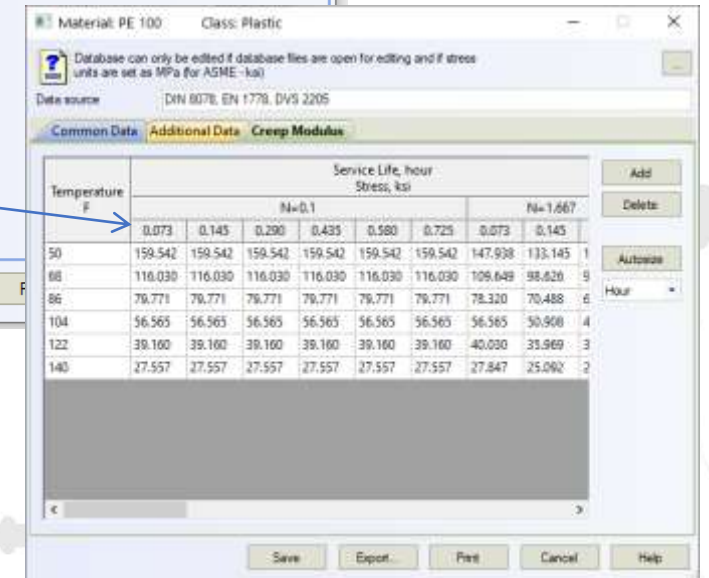
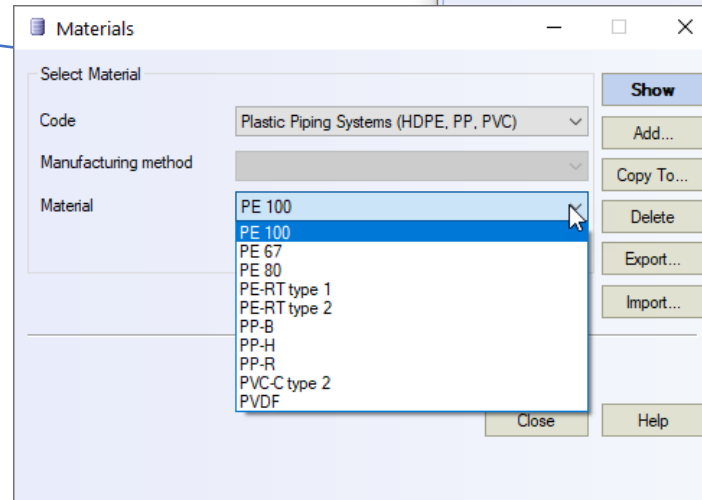
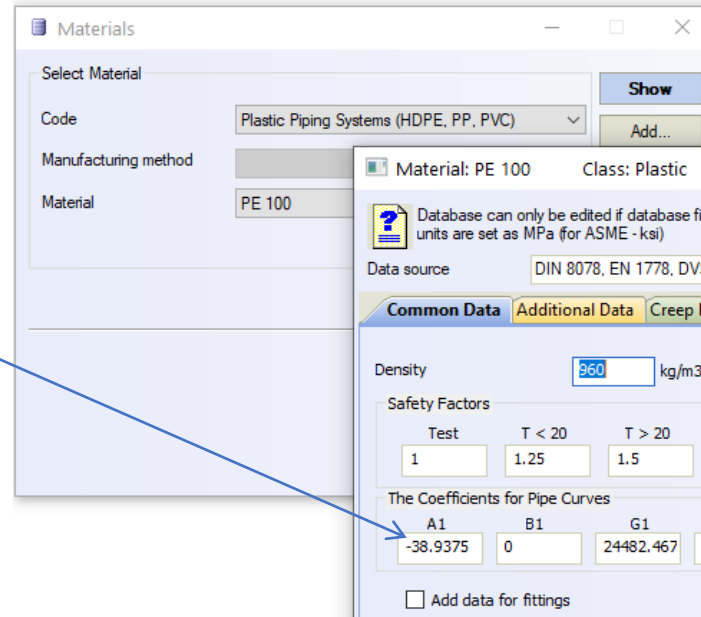


# PASS/Start-Prof | Base de datos de materiales

Bases de datos de materiales para cada código.

Base de datos tubería termoplástica (HDPE)

- Contiene los factores para calcular esfuerzo permisible dependiendo del tiempo y temperatura
- Contiene creep modulus dependiendo de la temperatura, tiempo, y esfuerzo



# PASS/Start-Prof | Capacidades para análisis

---

PASS/START-PROF Incluye las habilidades para el análisis profesional de esfuerzos en las tuberías para Proceso y Potencia:

- Análisis no lineal de tolerancias, fricción, restricciones en un sentido, varillas giratorias, etc.
- Algoritmo especial que mejora la convergencia del modelo no lineal durante el análisis sin requerir ajuste manual (por tolerancias, restricciones en un sentido, o por fuerzas por fricción, etc.). Recibimos de los usuarios modelos que no convergen, los agregamos a nuestra colección de casos y continuamente mejoramos el algoritmo desde hace 55 años. Lo que permite la convergencia en el 99.9% de los modelos analizados.
- Flexibilidades y SIF en boquillas, tees y codos (ASME B31J, WRC 537/297, PD 5500, FEA)
- Verificación automática en boquillas, bombas y otros equipos (API, ISO, NEMA)
- Selección automática del resorte óptimo variable o constante empleando catálogos de fabricantes.

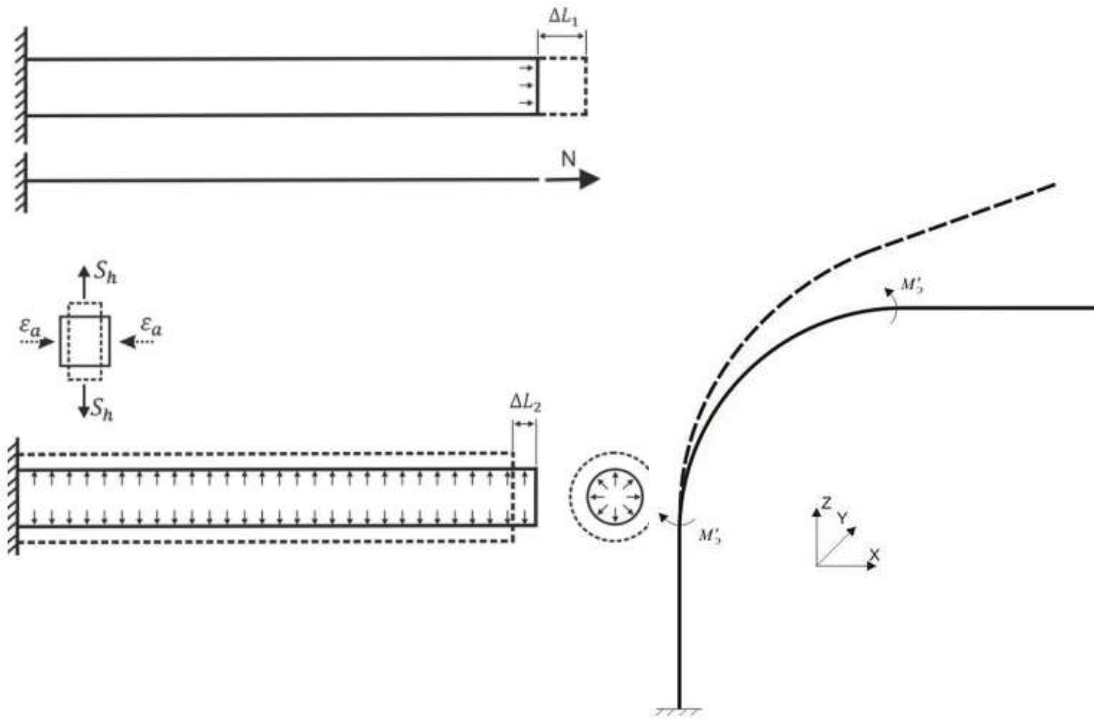


PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE



# PASS/Start-Prof | Capacidad para análisis

Efecto Bourdon (translación & giros)



	Unrestrained pipe $k = 0$	Restrained pipe $k = \infty$	Partially restrained pipe with flexible spring $k$
Support Load	$R = 0$	$R = \alpha \Delta T E A + (1 - 2\nu) A \frac{P(D - 2t)^2}{D^2 - (D - 2t)^2} \approx \alpha \Delta T E A + (0.5 - \nu) S_h \cdot A$	$R = \frac{\alpha \Delta T E A + (1 - 2\nu) A \frac{P(D - 2t)^2}{D^2 - (D - 2t)^2}}{\frac{EA}{kL} + 1} \approx \frac{\alpha \Delta T E A + (0.5 - \nu) S_h \cdot A}{\frac{EA}{kL} + 1}$
Axial Force	$N = P \frac{\pi(D - 2t)^2}{4} \approx 0.5 S_h \cdot A$	$N = -\alpha \Delta T E A + 2\nu \frac{P \pi(D - 2t)^2}{4} \approx -\alpha \Delta T E A + \nu S_h \cdot A$	$N = \frac{-\alpha \Delta T E A - 2\nu \frac{P \pi(D - 2t)^2}{4}}{\frac{EA}{kL} + 1} + \frac{P \pi(D - 2t)^2}{4} \approx \frac{-\alpha \Delta T E A - (0.5 - \nu) S_h \cdot A}{\frac{EA}{kL} + 1} + 0.5 S_h \cdot A$
Axial Stress	$S_a = \frac{P(D - 2t)^2}{D^2 - (D - 2t)^2} \approx 0.5 S_h$	$S_a = -\alpha \Delta T E + 2\nu \frac{P(D - 2t)^2}{D^2 - (D - 2t)^2} \approx -\alpha \Delta T E + \nu S_h$	$S_a = \frac{-\alpha \Delta T E - 2\nu \frac{P(D - 2t)^2}{D^2 - (D - 2t)^2}}{\frac{EA}{kL} + 1} + \frac{P(D - 2t)^2}{D^2 - (D - 2t)^2} \approx \frac{-\alpha \Delta T E - (0.5 - \nu) S_h}{\frac{EA}{kL} + 1} + 0.5 S_h$
Elongation	$\Delta L = \alpha \Delta T L + (1 - 2\nu) \frac{P(D - 2t)^2}{D^2 - (D - 2t)^2} \frac{L}{E} \approx \alpha \Delta T L + (0.5 - \nu) S_h \frac{L}{E}$	$\Delta L = 0$	$\Delta L = \left( \alpha \Delta T L + (1 - 2\nu) \frac{P(D - 2t)^2}{D^2 - (D - 2t)^2} \frac{L}{E} \right) \left( \frac{1}{\frac{EA}{kL} + 1} \right) \approx \left( \alpha \Delta T L + (0.5 - \nu) S_h \frac{L}{E} \right) \left( \frac{1}{\frac{EA}{kL} + 1} \right)$



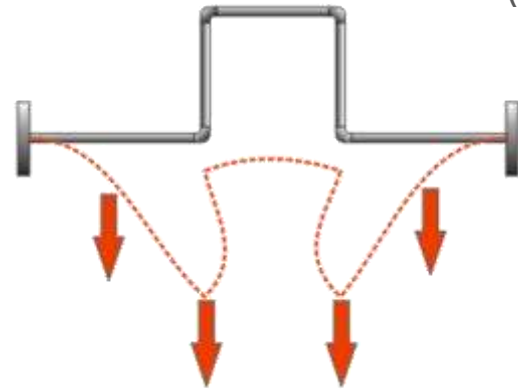
PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE



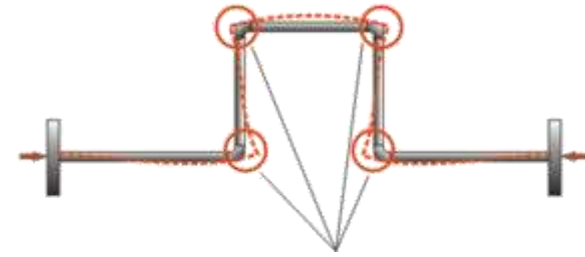
# PASS/Start-Prof | Capacidad para análisis

Calcule los esfuerzos de fluencia en el estado de operación y después cuando el sistema se encuentra en frío (relajación)

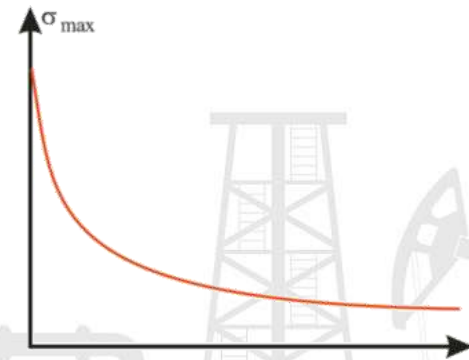
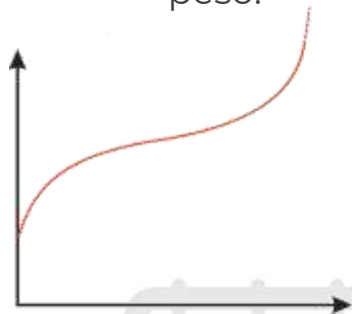
Calcule las cargas de los soportes por el efecto de deslizamiento después de enfriarse con el efecto de resorte en frío en forma automática (ASME B31.3 319.2.3 a)



La fluencia conduce al aumento de las deformaciones de las cargas de peso.



La fluencia conduce al esfuerzo de expansión y soporta cargas de relajación (reducción) con el tiempo



PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

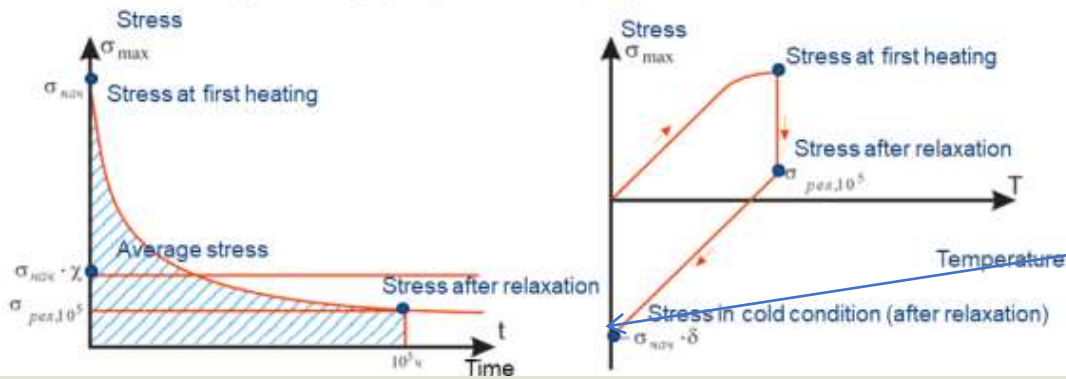


# PASS/Start-Prof | Capacidad para análisis

Calcule los esfuerzos de fluencia en el estado de operación y después cuando el sistema se encuentra en frío (relajación)

Calcule las cargas de los soportes por el efecto de deslizamiento después de enfriarse con el efecto de resorte en frío en forma automática (ASME B31.3 319.2.3 a)

Creep lead to piping self cold-spring in cold condition



### 319.2.3 Displacement Stress Range

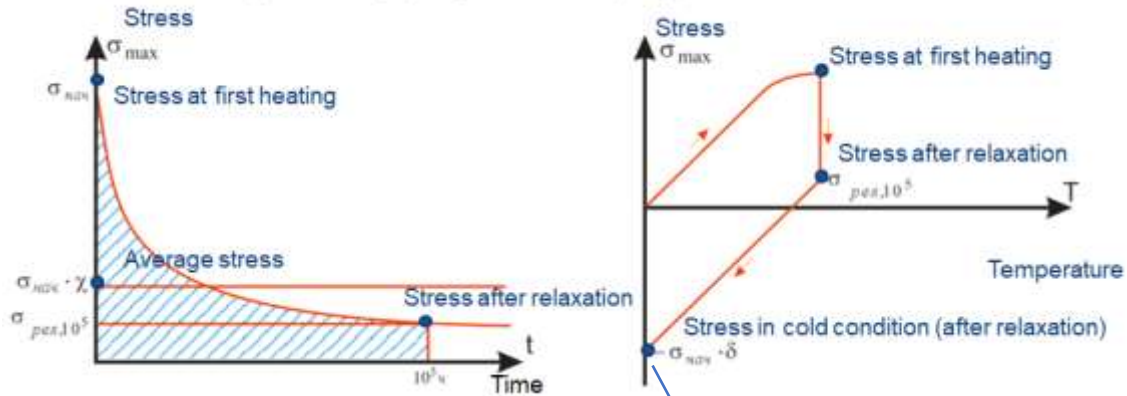
(a) In contrast with stresses from sustained loads, such as internal pressure or weight, displacement stresses may be permitted to attain sufficient magnitude to cause local yielding in various portions of a piping system. When the system is initially operated at the condition of greatest displacement (highest or lowest temperature, or greatest imposed movement) from its installed condition, any yielding or creep brings about a reduction or relaxation of stress. When the system is later returned to its original condition (or a condition of opposite displacement), a reversal and redistribution of stresses occurs that is referred to as self-springing. It is similar to cold springing in its effects.

Object	Start End node	Primary Loads Stress in Hot State, (ksi)			Expansion Stress Range, (ksi)			Creep Stress (Operating State), (ksi)			Creep Stress (Cold State), (ksi)			Notes
		SI	Sh*Wc/E	%	Se	Sa	%	Slcreep	Sh, creep	%	Slcreep	Sc, creep	%	
Above ground pipe	14	4.733	15.215	31.1	4.795	45.535	10.5	4.762	12.172	39.1	7.364	30	24.5	
	29,2 Flange	6.244	15.215	41.0	4.127	44.025	9.4	6.103	12.172	50.1	8.580	30	28.6	
Forged Elbow	29,2 Flange	7.270	15.215	47.8	7.012	43.060	16.3	7.033	12.172	57.8	10.611	30	35.4	
Above ground pipe	29,2 Flange	6.491	15.215	42.7	4.542	43.778	10.4	6.254	12.172	51.4	9.429	30	31.4	
	15	3.422	15.215	22.5	5.656	46.847	12.1	3.989	12.172	32.8	7.435	30	24.8	
Above ground pipe	14	4.923	15.215	32.4	16.859	45.346	37.2	5.603	12.172	46.0	20.829	30	69.4	
	16	5.016	15.215	33.0	13.674	45.252	30.2	5.687	12.172	46.7	16.348	30	54.5	
Weldolet (branch welded-on fitting)	16	10.051	15.215	66.1	75.640	41.251	183.4	13.462	12.172	110.6	60.670	30	202.2	33,13,14,333
Above ground pipe	16	4.204	15.215	27.6	8.415	46.065	18.3	5.036	12.172	41.4	9.884	30	32.9	
	30.1 flange	5.406	15.215	36.1	3.603	44.773	8.0	5.621	12.172	46.2	6.755	30	22.5	

**¡A menudo, las mayores tensiones y cargas de soporte se encuentran en estado frío después de la relajación progresiva debido al efecto de resorte en frío!**

# PASS/Start-Prof | Capacidad para análisis

Creep lead to piping self cold-spring in cold condition



**¡A menudo, las mayores tensiones y cargas de soporte se encuentran en estado frío después de la relajación progresiva debido al efecto de resorte en frío!**

Operating Mode		Load Case			Axis			Support Type	
1 'CTAPT1'		Cold Creep (W+P)-T*d			Global axis			Anchor (fixed), Resting...	
Node Number	Type	Forces along coordinate axis, (kgf)			Moments around coordinate axis, (kgf.cm)				
		X	Y	Z	X	Y	Z		
5,Bend	Anchor (fixed)	-4821.20	-741.20	-516.80	-7516.52	-164260.46	310608.63		
7,Bend	Anchor (fixed)	-15296.50	6107.60	-508.40	-134784.76	68006.50	1955982.59		
9	Anchor (fixed)	4594.90	-2450.80	-474.70	25199.76	149356.38	-211296.82		
11	Anchor (fixed)	738.80	282	-1175.80	98675.08	-172333.62	-52396.02		
13	Resting Support	0	0.10	39.20	0	0	0		
15	Anchor (fixed)	143.70	-102.60	-850.80	-63010.91	33497.13	-33351.85		
17	Anchor (fixed)	25.40	-259.90	-742.60	-125347.83	66853.35	-23842.90		
19	Anchor (fixed)	182.20	-481.60	-881	-210262.61	17410.30	-13870.44		
21	Anchor (fixed)	14432.80	-2353.50	15.30	-27776.98	425.14	-456489.75		



# PASS/Start-Prof | Capacidad para análisis

EN 13480 Las tensiones de fluencia se calculan automáticamente sin ningún esfuerzo manual del usuario

e) For the combination of sustained loads and restrained thermal expansion loads

$$\sigma_4 = \frac{p_c D_o}{4e_n} + 0,75i \frac{M_A}{Z} + i \frac{M_C}{Z} + \sigma_{MT} + \frac{\sigma_{PT}}{2} \leq f_h + f_a, \text{ and } 0,75i \geq 1,0 \quad (11.6-5)$$

La base de datos para EN 13480 contiene toda la información necesaria para análisis por falla

The screenshot displays the material database for EN 13480. The material selected is 1.0345/P235GH, Class: Carbon or Low Alloy Steel. The data source is EN 10216-2:2013. The density is 7850 kg/m³ and the factor A is 23. The table below shows the material properties for different thicknesses (Th) and temperatures (T).

Th, mm	Yield Stress (Rp), kgf/sq.cm	Tensile Strength (Rm), kgf/sq.cm
18	2350	3600
40	2250	3600
60	2150	3600

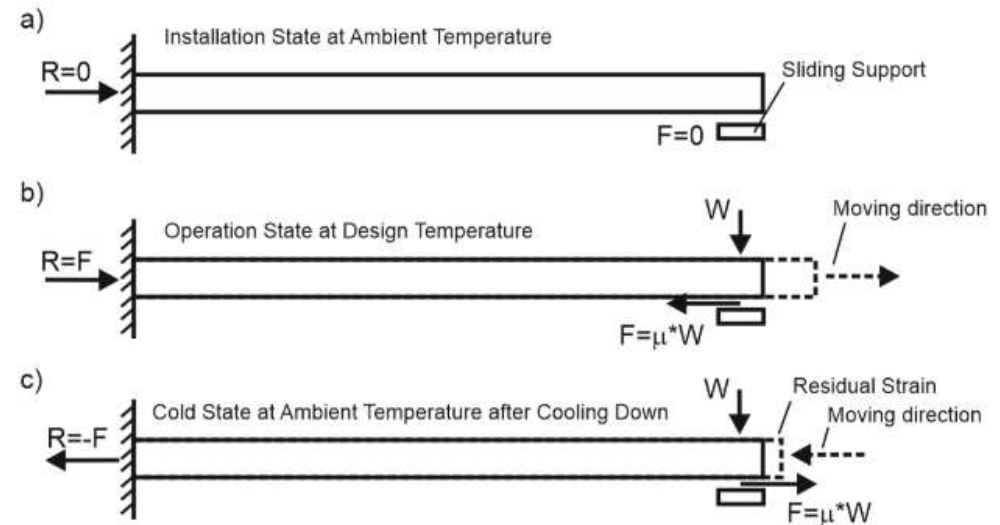
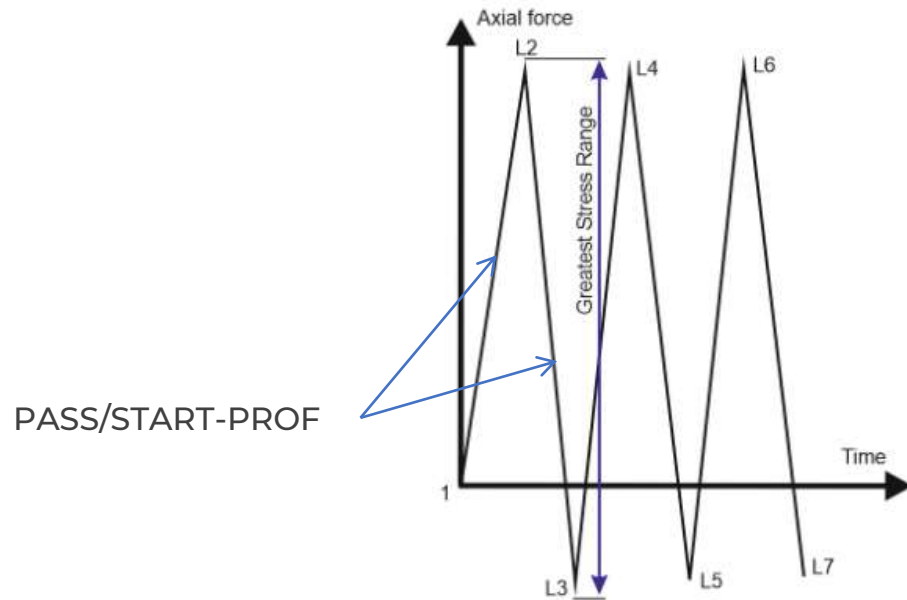
Temperature °C	Yield Stress (Rp), kgf/sq.cm	Tensile Strength (Rm), kgf/sq.cm	Elastic Modulus, kgf/sq.cm	Expansion Coeff., 1/°C	Poisson's Ratio (ν)	SRT 10 000 h, kgf/sq.cm	SRT 100 000 h, kgf/sq.cm	SRT 200 000 h, kgf/sq.cm	SRT 250 000 h, kgf/sq.cm
20	0	0	2117710	1,1209e-005	0,3	0	0	0	0
100	1980	3600	2000680	1,19e-005	0,3	0	0	0	0
150	1870	3600	2023850	1,2248e-005	0,3	0	0	0	0
200	1700	3600	1986100	1,2574e-005	0,3	0	0	0	0
250	1500	3600	1947450	1,2879e-005	0,3	0	0	0	0
300	1320	3600	1907880	1,3165e-005	0,3	0	0	0	0
350	1200	3600	1867410	1,3425e-005	0,3	0	0	0	0
400	1120	3600	1828020	1,3666e-005	0,3	1820	1410	1280	1220
410	1112	3600	1817630	1,3711e-005	0,3	1690	1280	1150	1090
420	1104	3600	1809200	1,3756e-005	0,3	1510	1140	1020	970
430	1096	3600	1800740	1,38e-005	0,3	1380	1000	890	860



PIPING AND EQUIPMENT ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Capacidad para análisis

START-PROF analiza el estado del sistema después del enfriamiento desde el estado caliente. Lo que permite obtener un rango más realista de los esfuerzos por expansión.



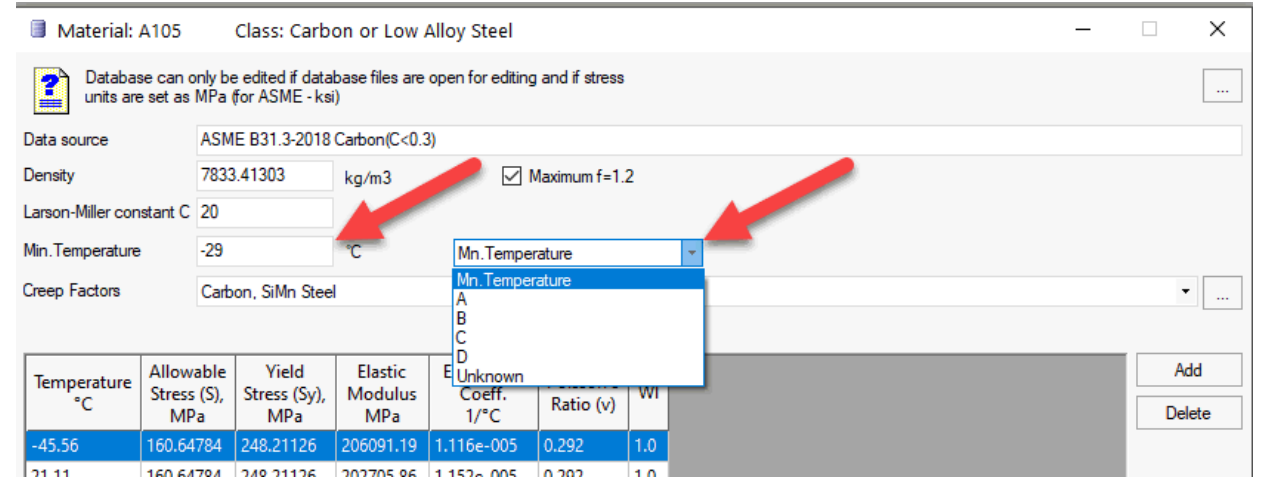
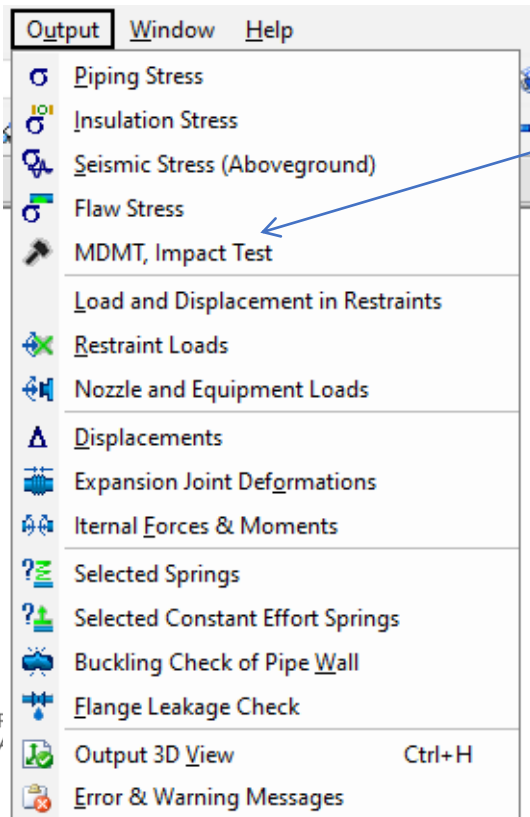
PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE



# PASS/Start-Prof | Capacidad para análisis

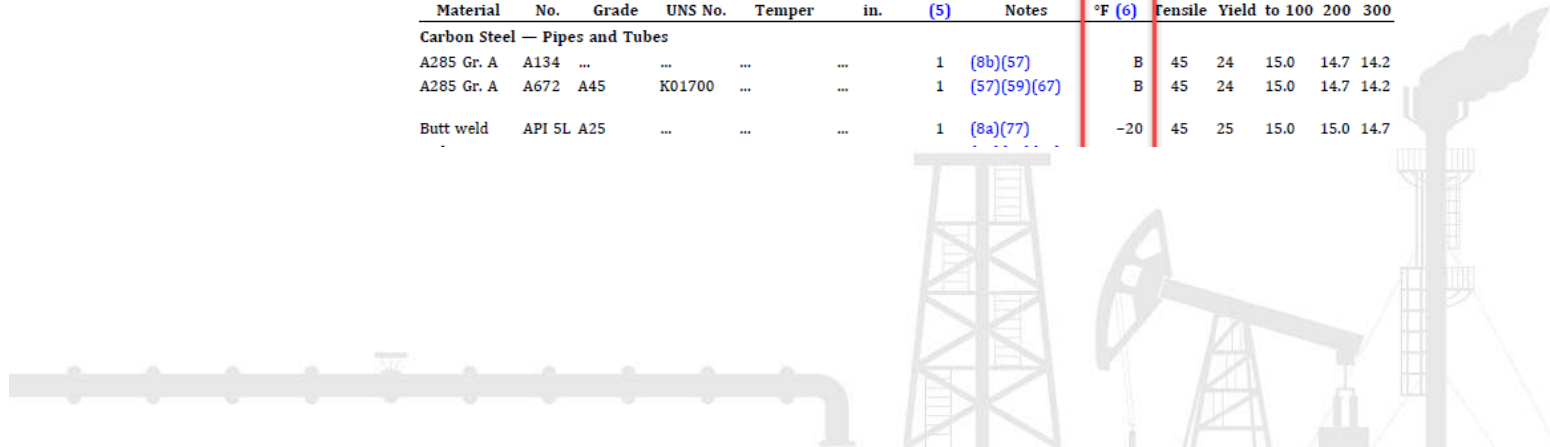
Cálculo de temperatura mínima del material para el diseño (MDMT) de acuerdo con 323.2.2 (a), (b), (d), (e), (f), (g), (h), (i), (j) of ASME B31.3-2018.

La base de datos contiene todos los datos que se requieren.



**Table A-1 Basic Allowable Stresses in Tension for Metals (Cont'd)**  
 Numbers in Parentheses Refer to Notes for Appendix A Tables: Specifications Are ASTM Unless Otherwise Indicated

Material	Spec. No.	Type/Grade	UNS No.	Class/Condition/Temp	Size, in.	P-No. (5)	Notes	Specified Min. Strength, ksi		Basic Allowable Stress, S, ksi, at Metal Temperature, °F [Note (1)]				
								Tensile	Yield	100	200	300		
<b>Carbon Steel — Pipes and Tubes</b>														
A285 Gr. A	A134	...	...	...	...	1	(8b)(57)	B	45	24	15.0	14.7	14.2	
A285 Gr. A	A672	A45	K01700	...	...	1	(57)(59)(67)	B	45	24	15.0	14.7	14.2	
Butt weld	API 5L	A25	...	...	...	1	(8a)(77)	-20	45	25	15.0	15.0	14.7	



# PASS/Start-Prof | Capacidad para análisis

PASS / START-PROF calcula el MDMT de acuerdo con la figura 323.2.2A y la figura 323.2.2B dependiendo de la relación de esfuerzo calculada, si el usuario seleccionó la opción adecuada en la configuración del proyecto, teniendo en cuenta los requisitos del código 323.2.2 (g), (h) , (i).

Después del análisis, se muestra en la tabla del informe de salida. Para cada tubería, START-PROF muestra si la prueba de impacto es necesaria o no

Object	Start End node	Thickness, cm	Material	Stress Ratio, r	Tmin, °C	MDMT, °C	Output
Above ground pipe	3,Restrained	0.600	A106 B	0.294	-40	-48	OK
Above ground pipe	23	0.600	A106 B	0.395	-40	-48	OK
	5,Bend	0.600	A106 B	0.840	-40	-37.869	Impact Test
Above ground pipe	6,0 Flange	0.600	A106 B	0.436	-40	-48	OK
	24	0.600	A106 B	0.400	-40	-48	OK
Above ground pipe	6,0 Flange	0.600	A106 B	0.342	-40	-48	OK
	8	0.600	A106 B	0.373	-40	-48	OK
Above ground pipe	8	0.600	A106 B	0.317	-40	-48	OK
	25	0.600	A106 B	0.283	-40	-48	OK
Above ground pipe	27	0.600	A106 B	0.430	-40	-48	OK
	9	0.600	A106 B	0.951	-40	-31.783	Impact Test
Above ground pipe	8	0.600	A106 B	0.330	-40	-48	OK

Figure 323.2.2A Minimum Temperatures Without Impact Testing for Carbon Steel Materials  
(See Table A-1 or Table A-3M for Designated Curve for a Listed Material; see Table 323.2.2A for Tabular Values)

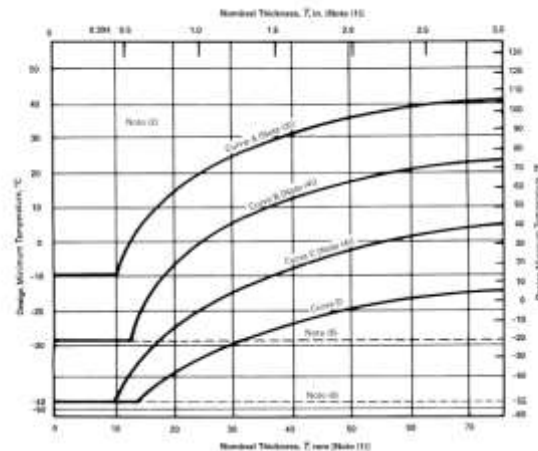
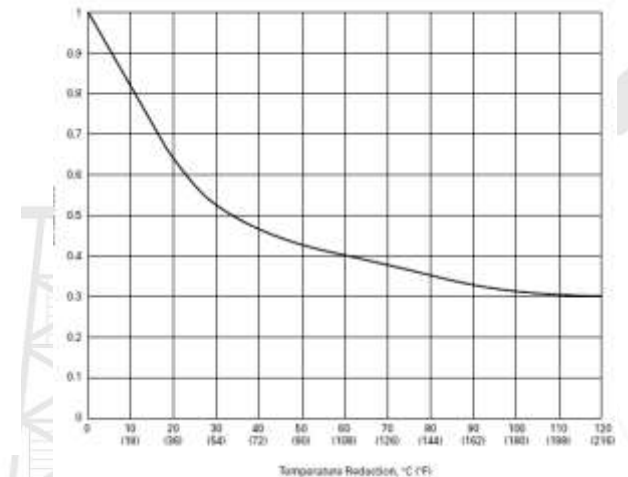


Figure 323.2.2B Reduction in Lowest Exemption Temperature for Steels Without Impact Testing  
(See Table 323.2.2B for Tabular Values)



PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Capacidad para análisis

Cálculo ocasional alternativo permisible para servicio de fluidos a temperaturas elevadas 302.3.6 (2) ASME B31.3-2018, se agregó el apéndice V.

Opciones "Ocasionales Alternativas" de "Duración en el tiempo", en el editor de modo operativo.

Constante de Larson-Miller "C" en la base de datos de materiales ASME B31.3.



Operating Mode: 1.1 occ1.1

Object	Start End node	Primary Loads: Stress, (ksi)			Notes
		S <sub>1</sub> ,AK	k <sup>2</sup> Sh	%	
Above ground pipe	14	3.012	5.960	84.1	
Forge Elbow	29,2 Flange	9.444	Sh, 4.684 ksi		
Above ground pipe	29,2 Flange	7.805	Sy, 18.616 ksi		
Above ground pipe	15	4.266	n=3000 hour		
Above ground pipe	14	3.172	C=20		
Weldolet (branch welded-on fitting)	16	5.325	Fe, 401.384305068139 °C		
Above ground pipe	16	10.256	S02, 5.960 ksi		
Above ground pipe	16	3.967	min(4Sh, 0.8*0.9Sy, S02), 5.960 ksi		

Smart Operation Mode Editor

#	Name	Hanger Sizing	High temperature	Low temperature	Seismic	Wind	Snow	Ice	Reaction	Temperature	Weight	Temperature	Time duration	Mode type	Process range between	Help
1 (0)	OPE	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.00	1.00			0.00	SUS	1-1A	?
1.1 (0)	occ1.1	-	-	-	-	-	-	-	-	-	-	-	-	OCC Std		?
2 (2)	occ	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.00	1.00			0.00	OCC Std	2-1A	?
3 (1)	Test mode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						SUS OCC Std OCC Alt Test		?

include same or like material, weld metal composition, and welding process under equivalent, or more severe, sustained operating conditions.

### 302.3.6 Limits of Calculated Stresses Due to Occasional Loads

(a) Operation. Stresses due to occasional loads may be calculated using the equations for stress due to sustained loads in para. 320.2.

(1) Subject to the limits of para. 302.2.4, the sum of the stresses due to sustained loads, such as pressure and weight,  $S_s$ , and of the stresses produced by occasional loads, such as wind and earthquake, may be as much as 1.33 times the basic allowable stress provided in Table A-1 or Table A-1M at the metal temperature for

(-a) the weld strength reduction factor times 90% of the yield strength at the metal temperature for the occasional condition being considered

(-b) four times the basic allowable stress provided in Appendix A

(-c) for occasional loads that exceed 10 h over the life of the piping system, the stress resulting in a 20% creep usage factor in accordance with Appendix V

For (-a), the yield strength shall be as listed in ASME BPVC, Section II, Part D, Table Y-1 or determined in accordance with para. 302.3.2. The strength reduction factor represents the reduction in yield strength with long-term exposure of the material to elevated temperatures and, in the absence of more-applicable data, shall be taken as 1.0 for austenitic stainless steel and 0.8 for other mate-

able stress for castings shall have a quality factor,  $E_c$ . Where  $E_c$  exceeds two-thirds of yield strength, the allowable stress value shall be reduced in accordance with para. 302.3.2(e).

Test conditions are not subject to the provisions of para. 102.3. It is not necessary to apply the provisions of para. 102.3 to test loads.

Material: A106 A Class: Carbon or Low Alloy Steel

Database can only be edited if database files are open for editing and if stress units are set as MPa (for ASME - ksi)

Data source: ASME B31.3-2018 Carbon(C<0.3)

Density: 7833.41303  Maximum f=1.2

Larson-Miller constant C: 20

Creep Factors: Carbon, SiMn Steel

Temperature F	Allowable Stress (S), ksi	Yield Stress (Sy), ksi	Elastic Modulus ksi	Expansion Coeff. 1/F	Poisson's Ratio (v)	WI
-325	16	30	31400	5.5e-006	0.292	1.0
-200	16	30	30800	5.79e-006	0.292	1.0
-150	16	30	30300	5.9e-006	0.292	1.0
-50	16	30	29891	6.2e-006	0.292	1.0
70	16	30	29400	6.4e-006	0.292	1.0
100	16	30	29262	6.47e-006	0.292	1.0
200	16	27,500	28800	6.7e-006	0.292	1.0

Buttons: Save, OK, Cancel, Help

# PASS/Start-Prof | Capacidad para análisis

Cálculo automático del factor de uso por ruptura debido a fluencia según ASME B31.3-2018 Apéndice V (V303.1-V303.3)

## V303.2 Determine Creep-Rupture Usage Factor

The usage factor,  $u$ , is the summation of individual usage factors,  $t_i / t_{ri}$ , for all service conditions considered in para. V303.1. See eq. (V4).

$$u = \sum (t_i / t_{ri}) \quad (V4)$$

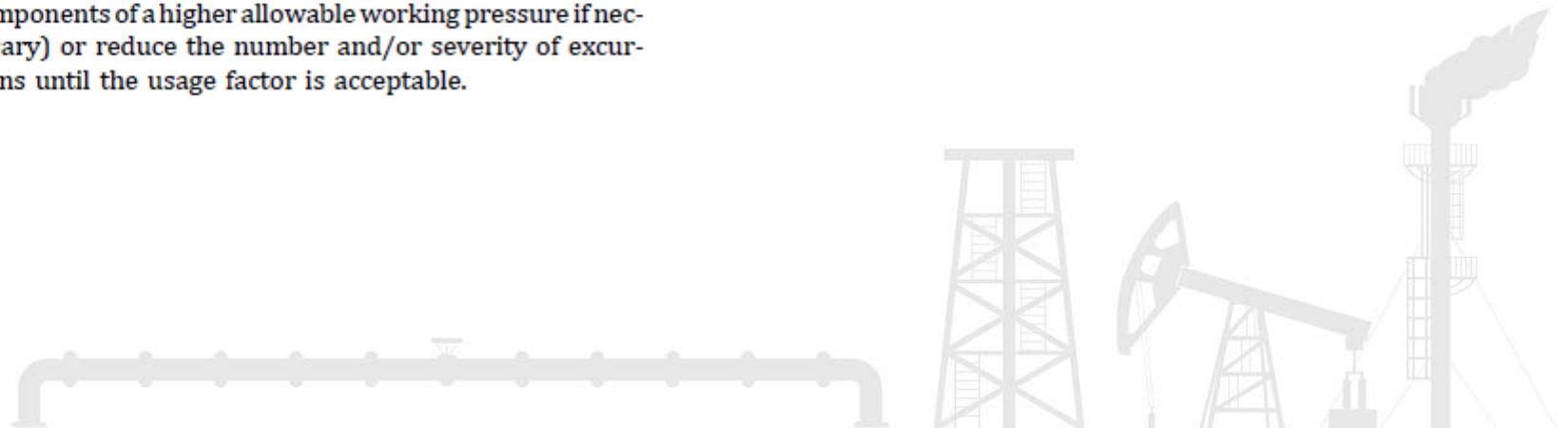
where

- $i$  = as a subscript, 1 for the prevalent operating condition;  $i = 2, 3$ , etc., for each of the other service conditions considered
- $t_i$  = total duration, h, associated with any service condition,  $i$ , at pressure,  $P_i$ , and temperature,  $T_i$
- $t_{ri}$  = as defined in para. V303.1.4

## V303.3 Evaluation

The calculated value of  $u$  indicates the nominal amount of creep-rupture life expended during the service life of the piping system. If  $u \leq 1.0$ , the usage factor is acceptable including excursions. If  $u > 1.0$ , the designer shall either increase the design conditions (selecting piping system components of a higher allowable working pressure if necessary) or reduce the number and/or severity of excursions until the usage factor is acceptable.

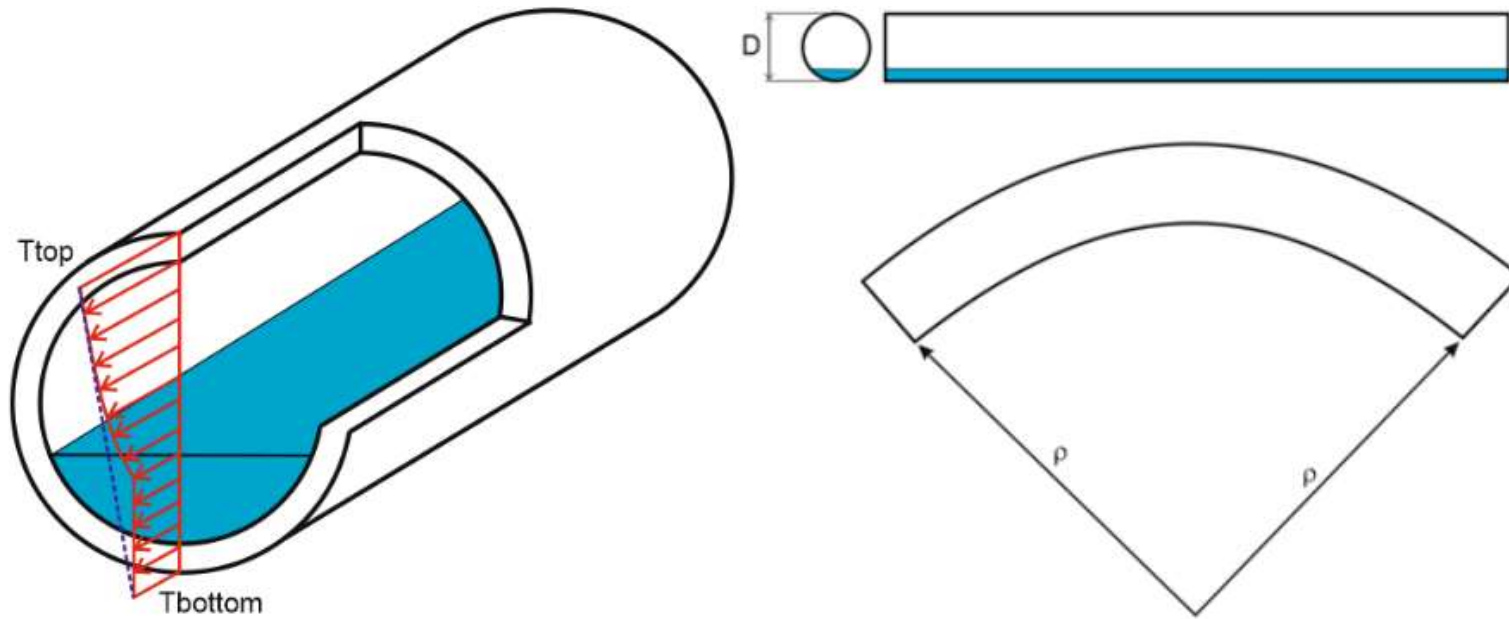
Temperature F	Allowable Stress (S), ksi	Yield Stress (Sy), ksi	Elastic Modulus ksi	Expansion Coeff. 1/F	Poisson's Ratio (ν)	WI
-325	16	30	31400	5.5e-006	0.292	1.0
-200	16	30	30800	5.79e-006	0.292	1.0
-150	16	30	30300	5.9e-006	0.292	1.0
-50	16	30	29891	6.2e-006	0.292	1.0
70	16	30	29400	6.4e-006	0.292	1.0
100	16	30	29262	6.47e-006	0.292	1.0
200	16	27.500	28800	6.7e-006	0.292	1.0





# PASS/Start-Prof | Capacidad para análisis

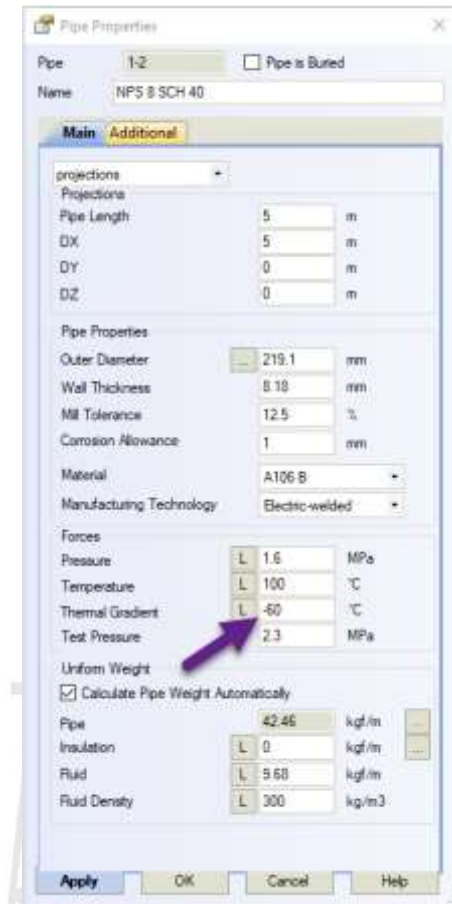
Thermal Bowing Analysis (análisis de arco térmico). Ocurre el fenómeno cuando una tubería horizontal se llena parcialmente con fluido caliente o frío. Muchos eventos de arqueamiento técnico causan daños inesperados a la tubería o estructura de soporte.



$$\frac{1}{\rho} = \frac{\alpha(T_{top} - T_{bottom})}{D}$$

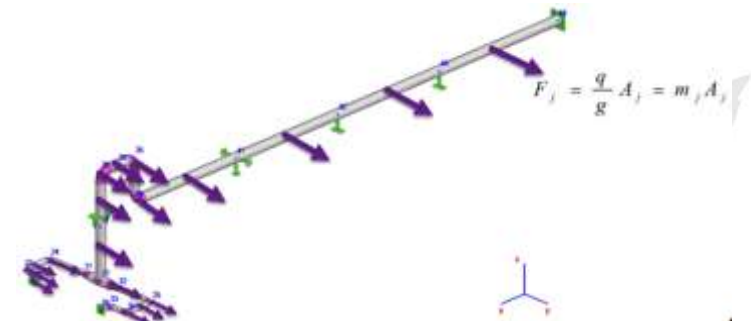
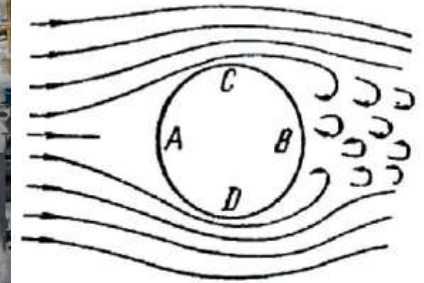
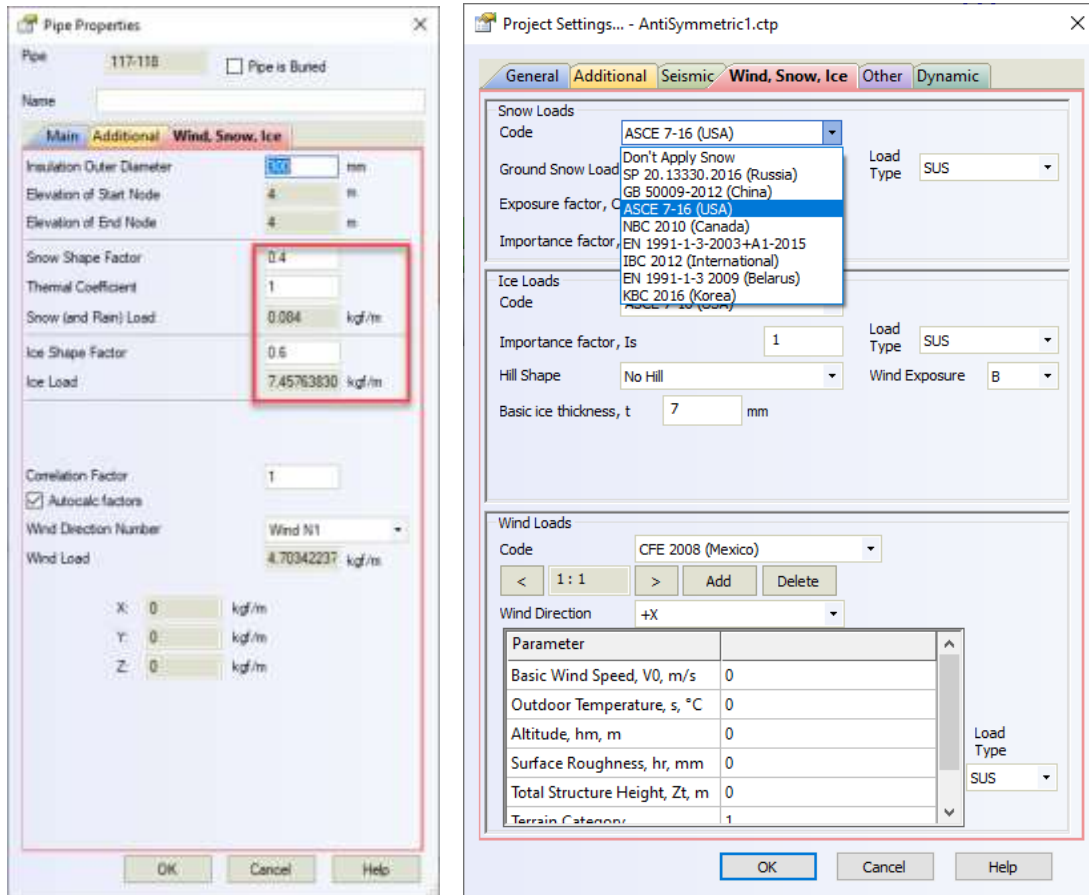


PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE



# PASS/Start-Prof | Capacidad para análisis

Generación automática de cargas por sismo, viento, nieve, hielo de acuerdo con 18 códigos



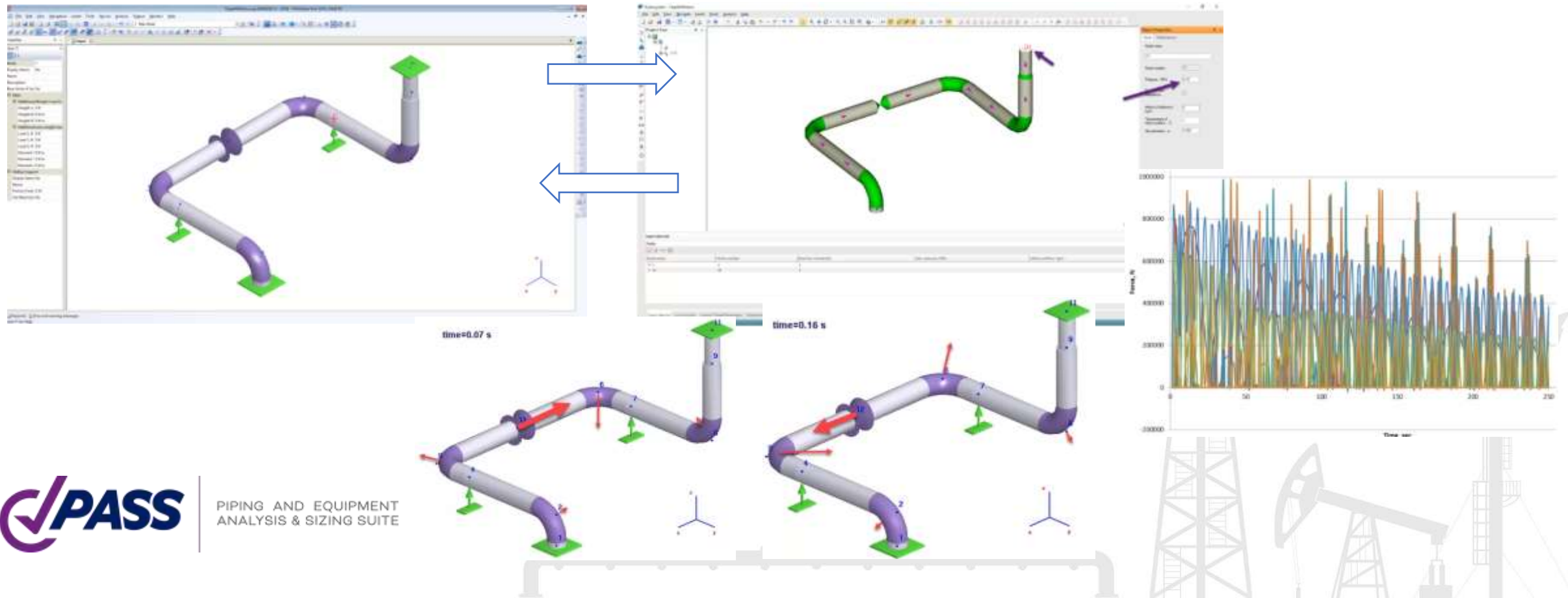
PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE



# PASS/Start-Prof | Capacidad para análisis

PASS/START-PROF + PASS/HYDROSYSTEM le permiten el análisis por sobrepresión y golpe de ariete

- Los modelos 3D de tubería se transfieren automáticamente de START-PROF a HYDROSYSTEM y viceversa
- Las cargas 3D se convierten simultáneamente para todos los nodos en el sistema en el mismo instante de tiempo

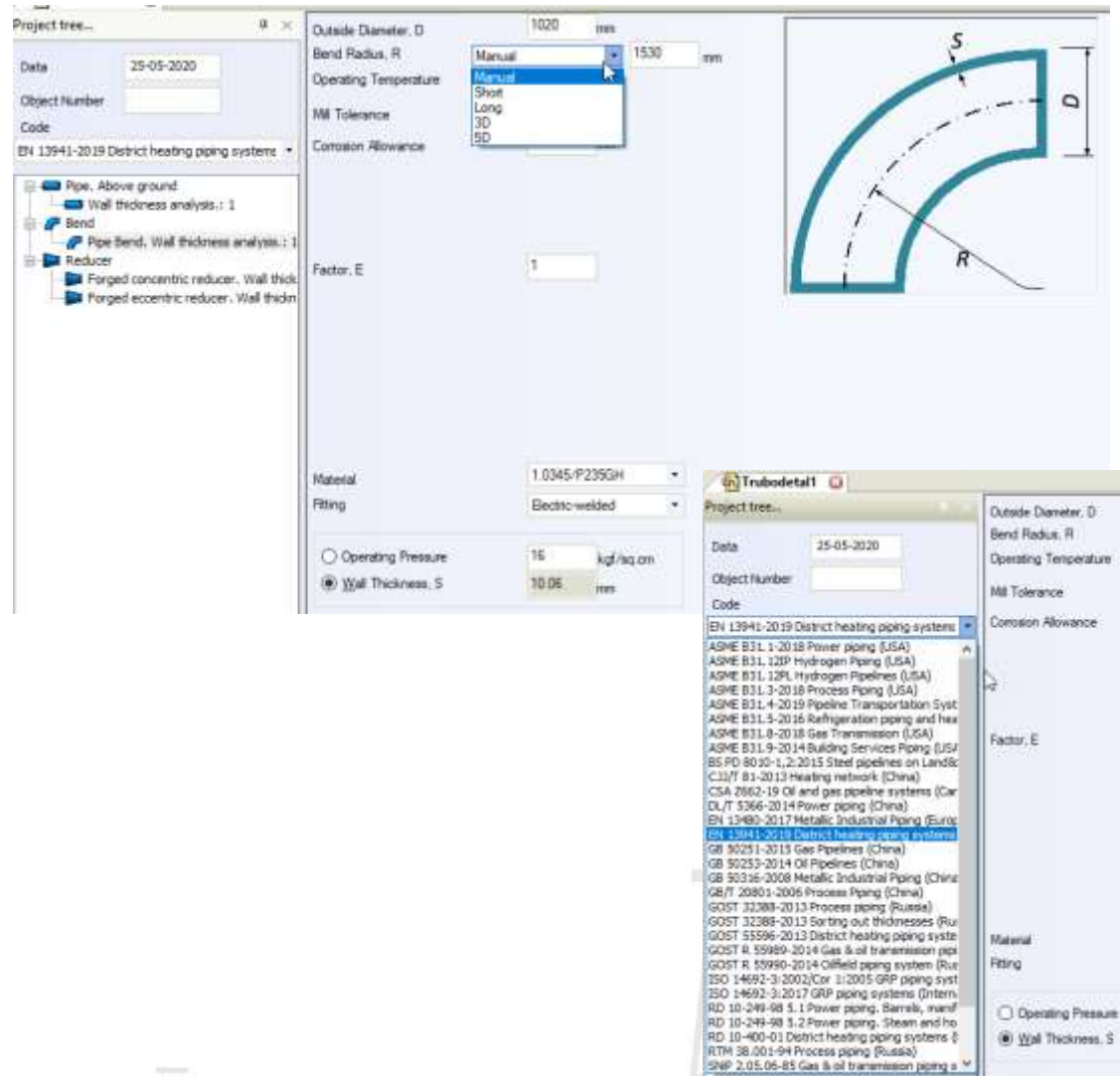


PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Elementos START

Cálculo de espesor de pared en tubería y codos para todos los códigos

Todos los espesores de pared en tubería y accesorios se verifica automáticamente antes de correr el análisis de esfuerzos de acuerdo con el Código seleccionado.

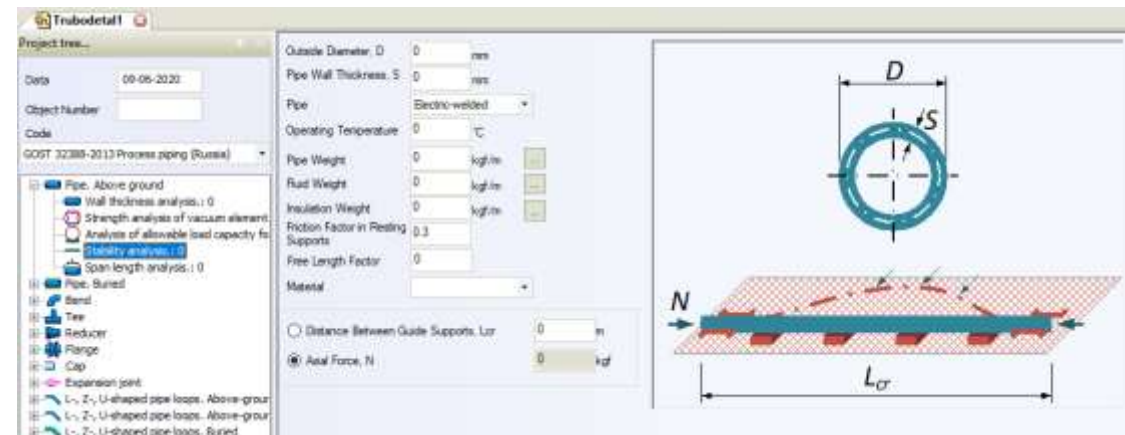
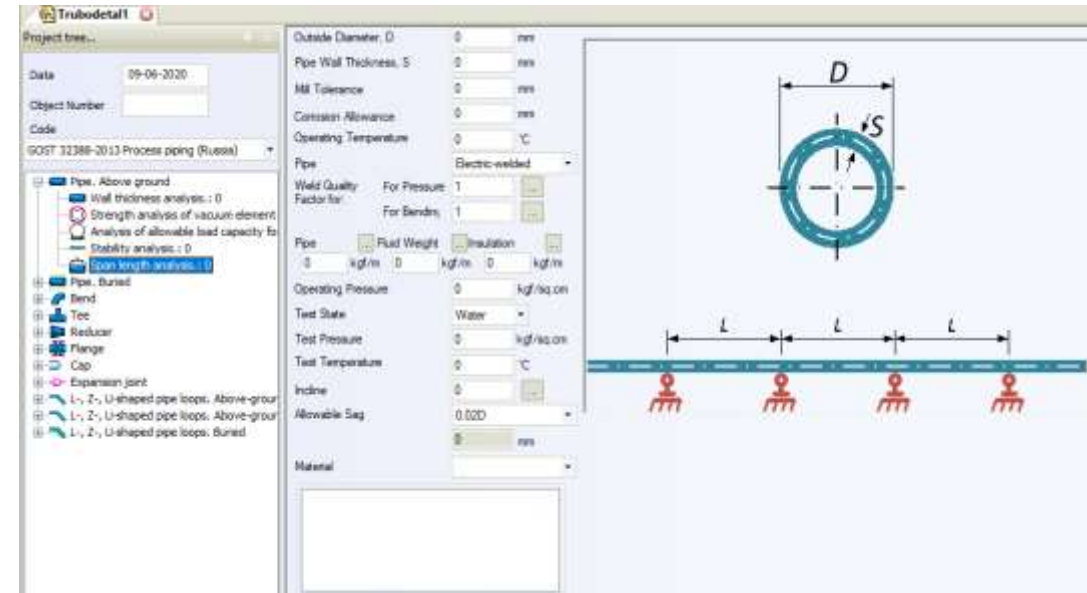


PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Elementos START

Análisis del espaciado entre soportes

Análisis de estabilidad longitudinal



PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Elementos START

Calcule el espesor de la pared en vacío y por carga externa

Análisis de curva de expansión simple

The image displays two overlapping screenshots of the Trubodetail1 software interface. The top screenshot shows the 'Project tree...' on the left with a tree structure including 'Pipe. Above ground', 'Pipe. Buried', 'Bend', 'Tee', 'Reducer', 'Flange', 'Cap', 'Expansion joint', and 'L-, Z-, U-shaped pipe loops'. The main panel on the right contains input fields for 'Outside Diameter, D' (0 mm), 'Operating Temperature' (0 °C), 'Pipe' (Electric-welded), 'Weld Quality Factor for Pressure' (1), 'Mill Tolerance' (0 mm), and 'Corrosion Allowance' (0 mm). A diagram of a pipe cross-section shows the diameter  $D$  and wall thickness  $S$ . The bottom screenshot shows a similar interface but with a different tree structure and parameters for 'Pipe Diameter, D', 'Pipe Wall Thickness, S', 'Operating Pressure', 'Material', 'Expansion joint back, B', 'Expansion joint leg, H', 'Allowable load on end support', 'Friction Factor in Resting Supports', 'Pipe', 'Weld Quality Factor for pressure' (1), 'bending' (0.5), 'Flexibility of bends' (ignore), 'Bend curve radius' (0 mm), and 'Compensated lengths' (L1, L2). A diagram of a U-shaped pipe loop shows dimensions  $B$ ,  $H$ ,  $R$ ,  $D$ ,  $S$ ,  $L_{guld}$ ,  $L_1$ , and  $L_2$ .



PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Creación del modelo

- No requiere crear manualmente los casos de carga
- Ahorra mucho tiempo y se protege de errores
- El Editor de Modo de Operación hará el trabajo por usted
- Fácil de usar y entender
- No hay límite en número de presiones y temperaturas

Generación automática de 67 casos de carga complejos a partir de 5 modos de operación en START-PROF

#	Name	High temperature	Cold State	Seismic	Wind	Snow/Ice	Use Load Factors	Friction Multiplier	Weight Multiplier	Mode Type	Stress Range Between
1	Operating	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1.00	1.00	SUS	1-1A, 1-2, 1-3, 1-4
1.1	Safety Valve Thrust 1	-	-	-	-	-	-	-	-	OCC	-
2	Operating 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.00	1.00	SUS	2-1, 2-1A, 2-3, 2-4
2.1	Safety Valve Thrust 2	-	-	-	-	-	-	-	-	OCC	-
3	Filling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.00	1.00	SUS	3-1A
4	Emergency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1.00	1.00	SUS	4-1A
5	Test	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-	-	Test	-

Simplified Load Case Templates. Real load case templates please see in help

Operation Mode #1: Operating  
L1: W1+P1 SUS Stress, Disp, Force, etc.  
L2: W1+P1+T1 OPE Disp, Force, etc.  
L3: L2+L1(≠1) EXP(1-1A) Stress  
L4: L2+L2(≠2) EXP(1-2) Stress  
L5: L2+L2(≠3) EXP(1-3) Stress  
L6: L2+L2(≠4) EXP(1-4) Stress  
L7: W1+P1+T1+5 Disp, Force, etc. (S - Snow)  
L8: L7+L2 Algebraic  
L9: L1+L8 Scalar SUS Stress  
L10: W1+P1+T1+1 Disp, Force, etc. (I - Ice)  
L11: L10+L2 Algebraic  
L12: L1+L11 Scalar SUS Stress  
L13: W1+P1+T1 +5Sesmic(+X) Disp, Force, etc.  
L14: L13+L2 Algebraic  
L15: L1+L14 Scalar OCC Stress  
L16: W1+P1+T1 +5Sesmic(-X) Disp, Force, etc.  
L17: L16+L2 Algebraic  
L18: L1+L17 Scalar OCC Stress  
L19: W1+P1+T1 +5Sesmic(+Y) Disp, Force, etc.  
L20: L19+L2 Algebraic  
L21: L1+L20 Scalar OCC Stress  
L22: W1+P1+T1 +5Sesmic(-Y) Disp, Force, etc.  
L23: L22+L2 Algebraic  
L24: L1+L23 Scalar OCC Stress  
L25: W1+P1+T1 +5Sesmic(+Z) Disp, Force, etc.  
L26: L25+L2 Algebraic  
L27: L1+L26 Scalar OCC Stress  
L28: W1+P1+T1 +5Sesmic(-Z) Disp, Force, etc.  
L29: L28+L2 Algebraic  
L30: L1+L29 Scalar OCC Stress  
L31: L1+MAX(L14,L17,...)^0.5 Scalar OCC Stress  
L32: L1+MAX(L14,L17,...)^0.5 Scalar OCC Stress  
L33: L2+MAX(L14,L17,...)^0.5 Disp, Force, etc.

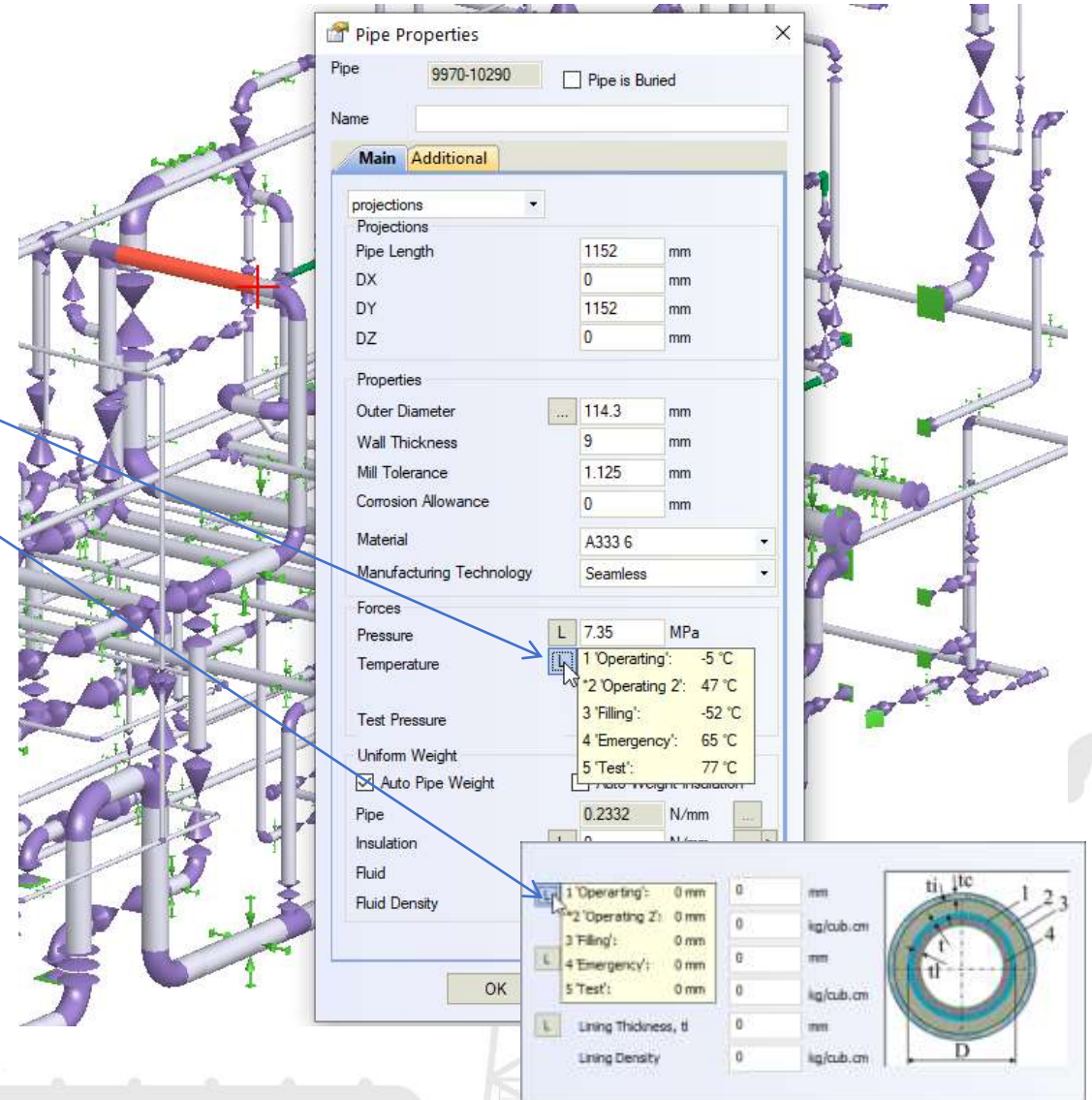


PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Creación de modelo

Diferentes modos de operación pueden tener diferentes:

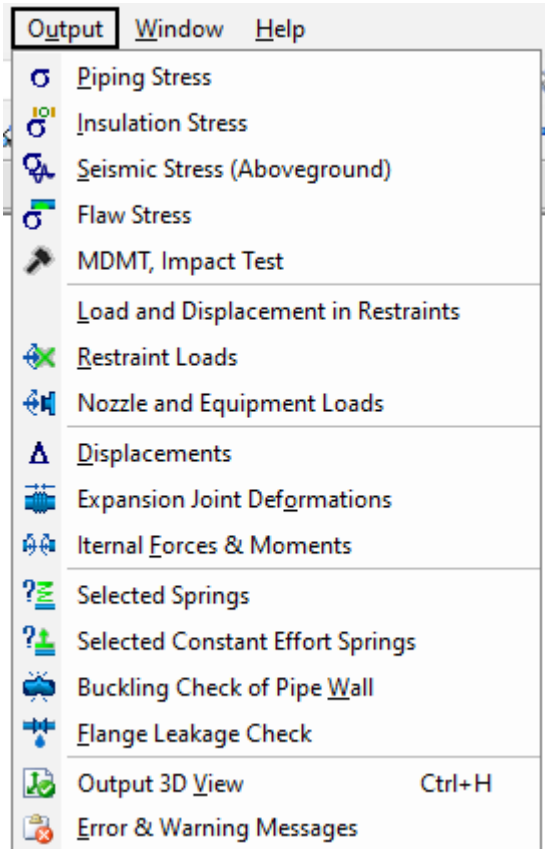
- Temperaturas 1-∞
- Presiones 1-∞
- Pesos de fluido 1-∞
- Desplazamientos de restricciones 1-∞
- Momentos y fuerzas, Cargas uniformes 1-∞
- Capas de aislamiento y densidad, peso 1-∞
- No hay límite para el número de presiones y temperatura
- No hay límite en número modos de operación
- Creación automática de casos de carga
- Reportes interactivos automáticos para todos los modos de operación





# PASS/Start-Prof | Reportes

Todos los reportes que necesite después del análisis



- Los reportes son interactivos. Por ejemplo, puede agregar o quitar esfuerzos desde fuerza axial en el momento, cambiar coordenadas global/local, agregar esfuerzos por arrastre, y demás.
- Los reportes se pueden copiar MS Excel
- Los reportes se pueden incluir en MS Word
- Disponible Free Viewer (Visualizador gratuito)  
Su cliente puede ver el modelo, ver los resultados del análisis



PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

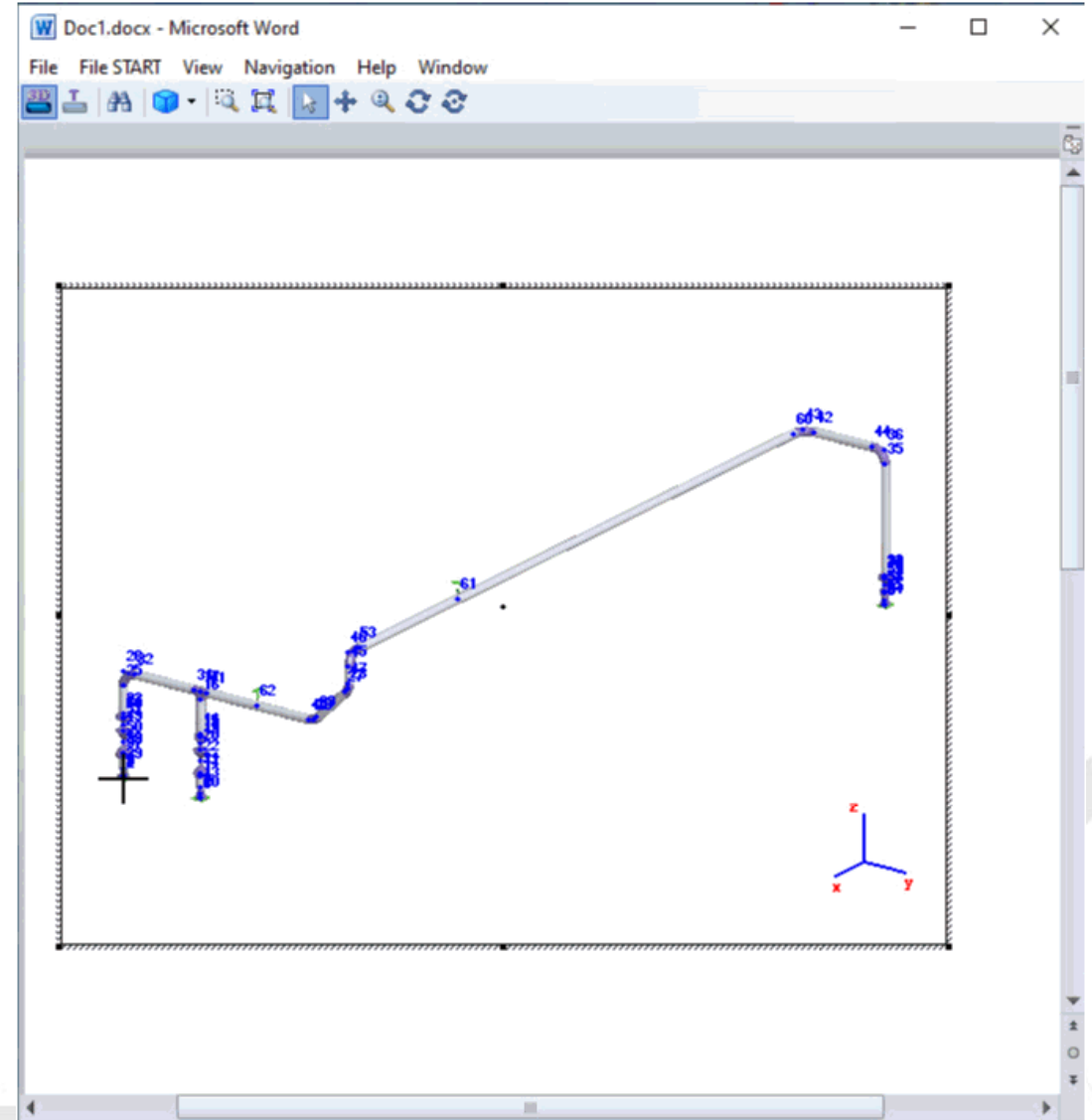


# PASS/Start-Prof | Características

La función "Copy Whole Model". Permite copiar todo el modelo de tubería como un objeto al portapapeles.

Después puede insertar este modelo interactivo en otro software como MS WORD, EXCEL etc. Usted puede girar, desplazar, acercar el modelo dentro de MS Word.

Usted puede agregar interacción al reporte en MS Word y enviar a su cliente para revisión.



PIPING AND EQUIPMENT  
ANALYSIS & SIZING SUITE

# PASS/Start-Prof | Reportes

Start-Prof Econom 2017 v.04.82 R2 - [Transfer 55-80 ASME B11.3.ctp - Load on Restraints and Equipment]

File Edit View Service Analysis Output Window Help

Input Loads

Operating Mode: 1 Main (0) Submode: Operation

Choose Axis: Global axis, Support local axis, Pipe local axis

Node Number	Type	Forces along coordinate axis, (kgf)			Moments around coord			
		X	Y	Z	X	Y	Z	
2	Console	Anchor (fixed)	0.10	0	-1151.20	0	-575458.38	0.01
3	Restrained	Anchor (fixed)	567378.30	0	-325.80	0	-54294.99	0
4	Restrained	Anchor (fixed)	-567378.30	0	-325.80	0	54295.04	0
5	Bend	Anchor (fixed)	3760.80	556.90	-554.50	-10066.75	-106026.59	-235113.50
7	Bend	Anchor (fixed)	13603.30	-5447.70	-1294.60	-302600.69	9588.95	-1653202.63
9	Anchor (fixed)		-3902.60	2185.80	-720	75899.34	237117.89	209446.26
11	Anchor (fixed)		-287.60	-131	-403	-83205.50	114312.74	54883.24
13	Sliding Support		-71.90	-102	-814.10	0	0	0
15	Anchor (fixed)		96.20	151.30	-486.60	25559.60	-32059.35	42000.25
17	Anchor (fixed)		126.90	247.60	-422.20	63066.41	-52465.34	34842.89
19	Anchor (fixed)		11.10	383.20	-348.40	116306.95	-26298.11	26296.48
21	Anchor (fixed)		-13362.30	2155.90	-543.80	-55819.34	112108.12	407537.56

Properties

Pipe (1-2)

Start Node: 1  
End Node: 2

Name: Projections

Input Type: Projections

Projections/a: 3000 mm, 0 mm

Diameter x T: 219.1 mm X 8.18

Pipe Material: 20

Mill Toleranc: 12.50

Corrosion All: 0 mm

Operating Pr: 1 MPa

Test Pressure: 1.5 MPa

Operating Te: 100 °C

Uniform Wes: Yes, 0.4167975 N

Additional

Longitudinal: 1.00

Circumferent: 1.00

Additional Lc: 0 N/mm, 0 N/mm

Error and warning messages

Type	Node/pipe	Description
Notes	Node:1	(N265) Failed the stress check from pressure and weight loads (1, 'Main')
Notes	Node:5	(N265) Failed the stress check from pressure and weight loads (1, 'Main')
Notes	Node:8	(N284) Failed the fatigue strength check (1, 'Main')
Notes	Node:8	(N284) Failed the fatigue strength check (1, 'Main')
Notes	Node:8	(N268) Failed the stress check in operation condition (1, 'Main')
Notes	Node:8	(N268) Failed the stress check in operation condition (1, 'Main')

Pipes list Error and warning messages

Для справки нажмите F1

Cargas en restricciones

START-PROF 04.82 R1 - [START1.ctp - Displacement]

File Edit View Service Analysis Output Window Help

Input Displ

Operating Mode: 1 Main mode Submode: Operation

Choose Axis: Global axis, Pipe local axis, Pipe local axis/azimuthal projectio, Pipe local axis

Node Number	Type	Displacement along coordinate axis, (mm)		
		X	Y	Z
1	Anchor (fixed)	0	0	0
2	Welding Tee	3	-1.1	-0.4
3	Single-direction Guide	6.1	0	0
4	Forged Elbow	2.8	1.6	1.3
6	Forged Elbow	2.3	-2.2	-0.6
8	Forged Elbow	0.7	-4.9	0.3
9	Sliding Support	0.1	-4	0
10	Anchor (fixed)	0	0	0
12	Spring Hanger	3	1.3	1.4

Error and warning messages

Type	Node/pipe	Description	Help
Warning	Node:1	(W522) Gap is not considered in the analysis, since it is too small	?
Warning	Node:2	Tee length must be greater than 0	?
Warning	Node:2	(W660) Dummy free end at pipe border may cause analysis inaccuracies if in fact the pipeline continues beyond this point	?
Information	-	(W562) Number of degrees of freedom 13	?

Pipes list Error and warning messages

Для справки нажмите F1

Desplazamientos

# PASS/Start-Prof | Reportes

- Los reportes muestran las ecuaciones empleadas
- Puede añadir/quitar tensiones desde la fuerza axial
- Activar funciones individuales para cada Código de esfuerzos en la tubería
- Se indica en rojo donde la verificación falla
- También en rojo la verificación de falla de esfuerzos junto con mensajes de advertencia

The screenshot displays the 'Start-Prof Econom 2017 v.04.02 R2 - [Transfer 56-80 ASME B31.3.ctp - Code Stress]' application. The main window shows a 'Stress' report with the following table structure:

Component	Code	Description	Stress range, (kgf/sq.cm)		Sustained with creep (Operating State), (kgf/sq.cm)		Sustained with creep (Cold State), (kgf/sq.cm)		Notes		
			Sh	Se	Slcreep	Sh, creep	Slcreep	Sh, creep			
Above ground pipe	1, Console	187.82	187.82	853.30	0	2458.05	187.82	1406.53	187.82	1768.51	
Above ground pipe	2, Console	3998.54	3998.54	853.30	0	1708.18	3998.54	1406.53	3998.54	1768.51	1,2,7,8,9,10
Above ground pipe	4, Restrained	494.99	472.22	853.30	14077.98	2150.88	19959.70	1406.53	359.55	1768.51	7,8
Forged Elbow	3, Restained	494.99	472.22	853.30	14077.98	2150.88	19959.70	1406.53	359.55	1768.51	7,8
Above ground pipe	6,0 Flange	703.33	646.32	853.30	14077.98	2150.88	19959.70	1406.53	1049.41	1768.51	1,2,3,7,8
Joint	24	646.32	646.32	853.30	14077.98	2150.88	19959.70	1406.53	706.01	1768.51	7,8
Above ground pipe	22	352.55	352.55	853.30	14077.98	2150.88	19959.70	1406.53	648.07	1768.51	
Eccentric Reducer	22	407	407	853.30	14077.98	2150.88	19959.70	1406.53	648.34	1768.51	
Above ground pipe	22	407	407	853.30	14077.98	2150.88	19959.70	1406.53	648.07	1768.51	
Concentric Reducer	23	629.84	629.84	853.30	14077.98	2150.88	19959.70	1406.53	648.07	1768.51	
Above ground pipe	23	629.84	629.84	853.30	14077.98	2150.88	19959.70	1406.53	648.07	1768.51	
Forged Elbow	5, Bend	1341.3	1341.3	853.30	14077.98	2150.88	19959.70	1406.53	648.07	1768.51	
Above ground pipe	6,0 Flange	1045.3	1045.3	853.30	14077.98	2150.88	19959.70	1406.53	648.07	1768.51	
Above ground pipe	8	600.39	600.39	853.30	14077.98	2150.88	19959.70	1406.53	648.07	1768.51	
Welding Tee	8	1183.7	1183.7	853.30	14077.98	2150.88	19959.70	1406.53	648.07	1768.51	
Above ground pipe	8	473.99	473.99	853.30	14077.98	2150.88	19959.70	1406.53	648.07	1768.51	
Non-standard bend	25	432.12	432.12	853.30	14077.98	2150.88	19959.70	1406.53	648.07	1768.51	
Above ground pipe	25	700.31	700.31	853.30	14077.98	2150.88	19959.70	1406.53	648.07	1768.51	
Above ground pipe	25	480.45	480.45	853.30	14077.98	2150.88	19959.70	1406.53	648.07	1768.51	

The yellow tooltip provides detailed stress equations and parameters for a specific component:

- Pressure, 16 kgf/sq.cm
- Inside Diameter(Do), 219 mm
- Thickness(t), 6 mm
- Moment of resistance (Z), 183886.244 cub.mm
- Pressure thrust stress (Sp=P\*(Do-2t)^2/(Do^2-(Do-2t)^2), 134.11 kgf/sq.cm
- Bending stress (Sb=0.75\*Mb/Z), 687 kgf/sq.cm
- Axial stress (Sa=F/A), 157.30 kgf/sq.cm
- Torsion shear stress (St=0.75\*Mt/2Z), -23.99 kgf/sq.cm
- SL=([Sa+ Sb]^2+(St)^2)^0.5, 1045.39 kgf/sq.cm
- Moment of resistance (Z), 183886.244 cub.mm
- Pressure thrust stress (Sp=P\*(Do-2t)^2/(Do^2-(Do-2t)^2), 134.11 kgf/sq.cm
- Bending stress (Sb=0.75\*Mb/Z), 687 kgf/sq.cm
- Axial stress (Sa=F/A), 157.30 kgf/sq.cm
- Torsion shear stress (St=0.75\*Mt/2Z), -23.99 kgf/sq.cm
- SL=([Sa+ Sb]^2+(St)^2)^0.5, 1045.39 kgf/sq.cm

The 'Error and warning messages' window at the bottom shows the following table:

Type	Node/pipe	Description
Notes	Node:8	(N265) Failed the st
Notes	Node:8	(N265) Failed the st
Notes	Node:8	(N284) Failed the fa
Notes	Node:8	(N284) Failed the fa
Notes	Node:8	(N268) Failed the st
Notes	Node:8	(N268) Failed the st

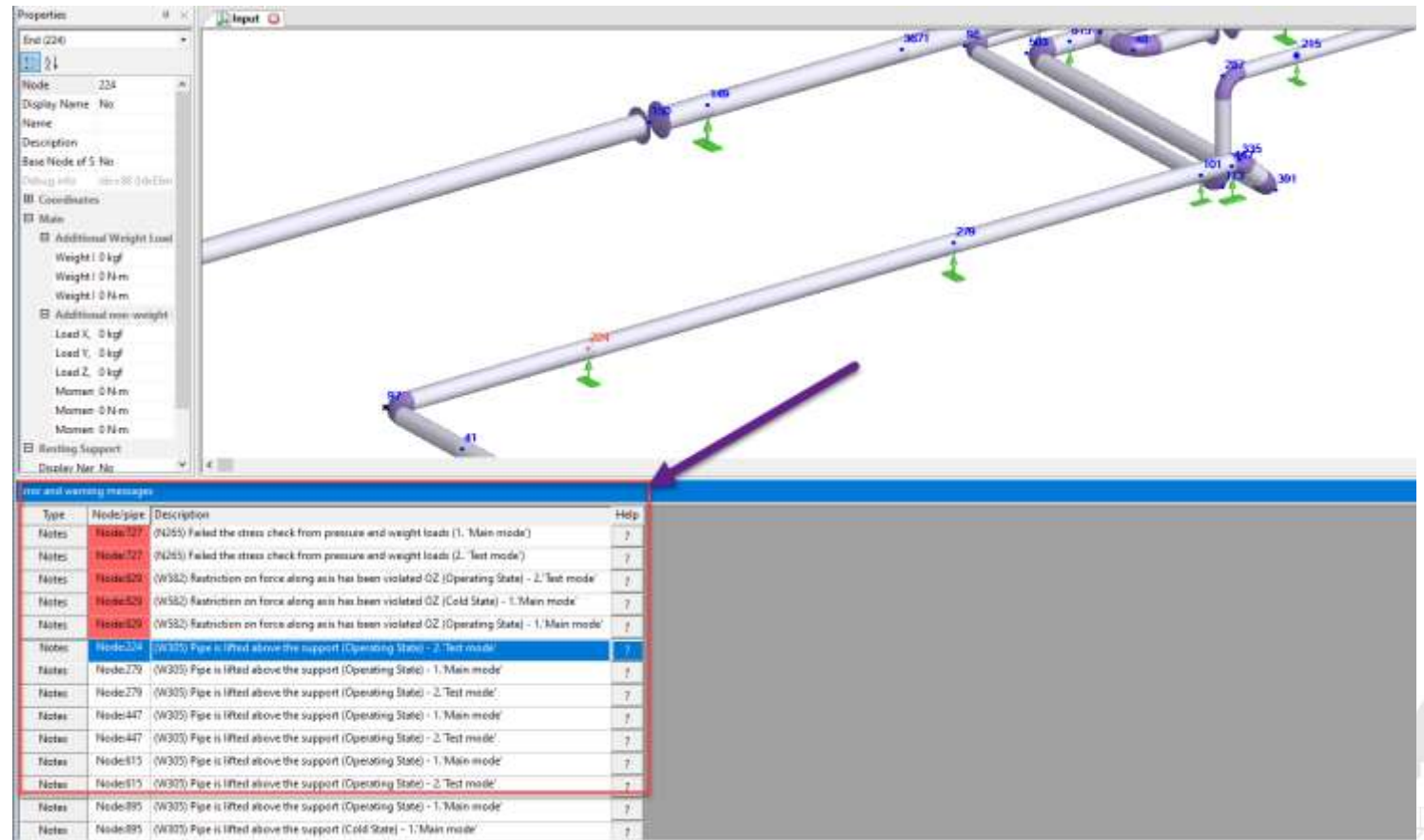


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# PASS/Start-Prof | Reportes

PASS/START-PROF tiene un inteligente verificador de fallas.

Se muestran advertencias tal como levantamiento del soporte, cargas del soporte mayores que el permisible, cargas del soporte mayores que el permisible, deformación mayor que el límite de la junta de expansión, falla del análisis por deformación, falla en la fuga de bridas, el rango mayor al 25% del resorte colgante variable, carga del resorte en un caso de carga mayor al permisible, límite excedido por giro de varilla y muchos otros.

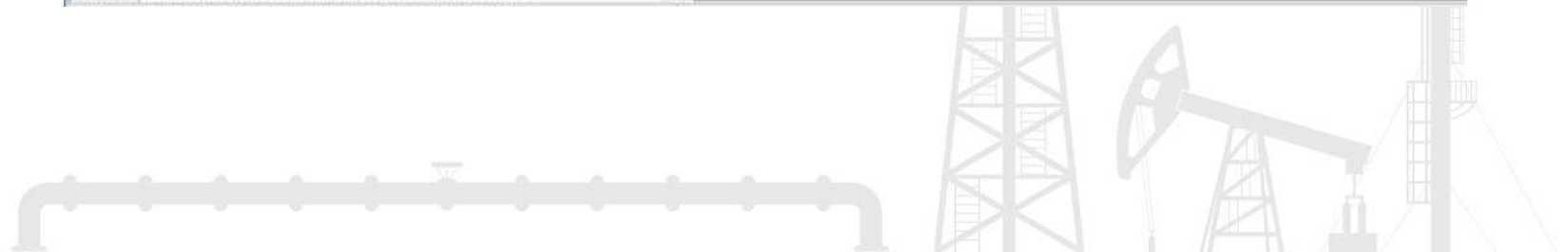


The screenshot displays the PASS/Start-Prof software interface. On the left, a 'Properties' panel shows details for a selected node (Node 234). The main window shows a 3D model of a piping system with various nodes and supports. A purple arrow points from the error/warning messages table to the 3D model. The table below lists the messages:

Type	Node/pipe	Description	Help
Notes	Node127	(W455) Failed the stress check from pressure and weight loads (1, Main mode)	?
Notes	Node127	(W455) Failed the stress check from pressure and weight loads (2, Test mode)	?
Notes	Node129	(W582) Restriction on force along axis has been violated (2 (Operating State) - 2, Test mode)	?
Notes	Node129	(W582) Restriction on force along axis has been violated (2 (Cold State) - 1, Main mode)	?
Notes	Node129	(W582) Restriction on force along axis has been violated (2 (Operating State) - 1, Main mode)	?
Notes	Node234	(W305) Pipe is lifted above the support (Operating State) - 2, Test mode	?
Notes	Node279	(W305) Pipe is lifted above the support (Operating State) - 1, Main mode	?
Notes	Node279	(W305) Pipe is lifted above the support (Operating State) - 2, Test mode	?
Notes	Node447	(W305) Pipe is lifted above the support (Operating State) - 1, Main mode	?
Notes	Node447	(W305) Pipe is lifted above the support (Operating State) - 2, Test mode	?
Notes	Node815	(W305) Pipe is lifted above the support (Operating State) - 1, Main mode	?
Notes	Node815	(W305) Pipe is lifted above the support (Operating State) - 2, Test mode	?
Notes	Node895	(W305) Pipe is lifted above the support (Operating State) - 1, Main mode	?
Notes	Node895	(W305) Pipe is lifted above the support (Cold State) - 1, Main mode	?



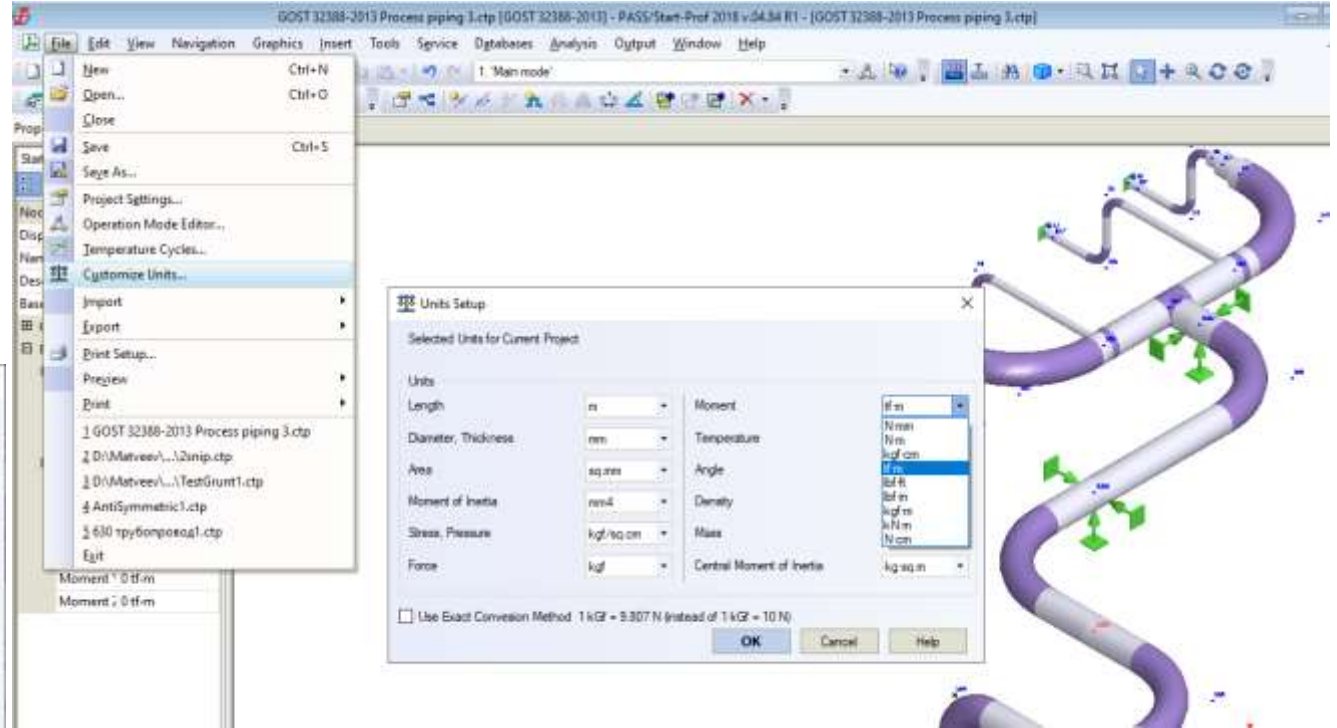
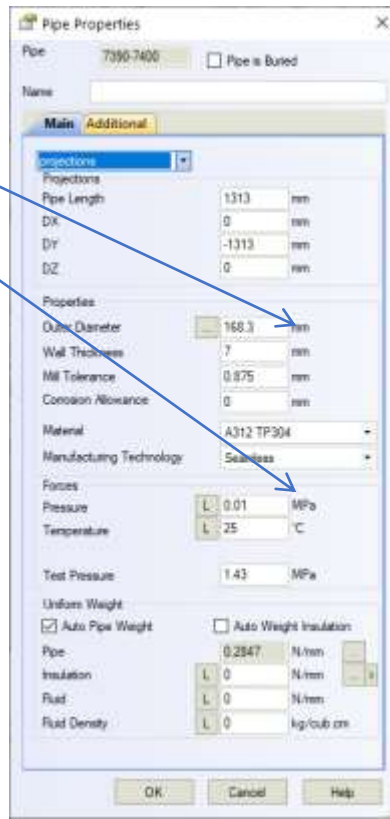
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# PASS/Start-Prof | Características

Puede cambiar las unidades en cualquier momento, incluso si ya corrió el análisis.

Se muestran siempre las unidades para cada valor.

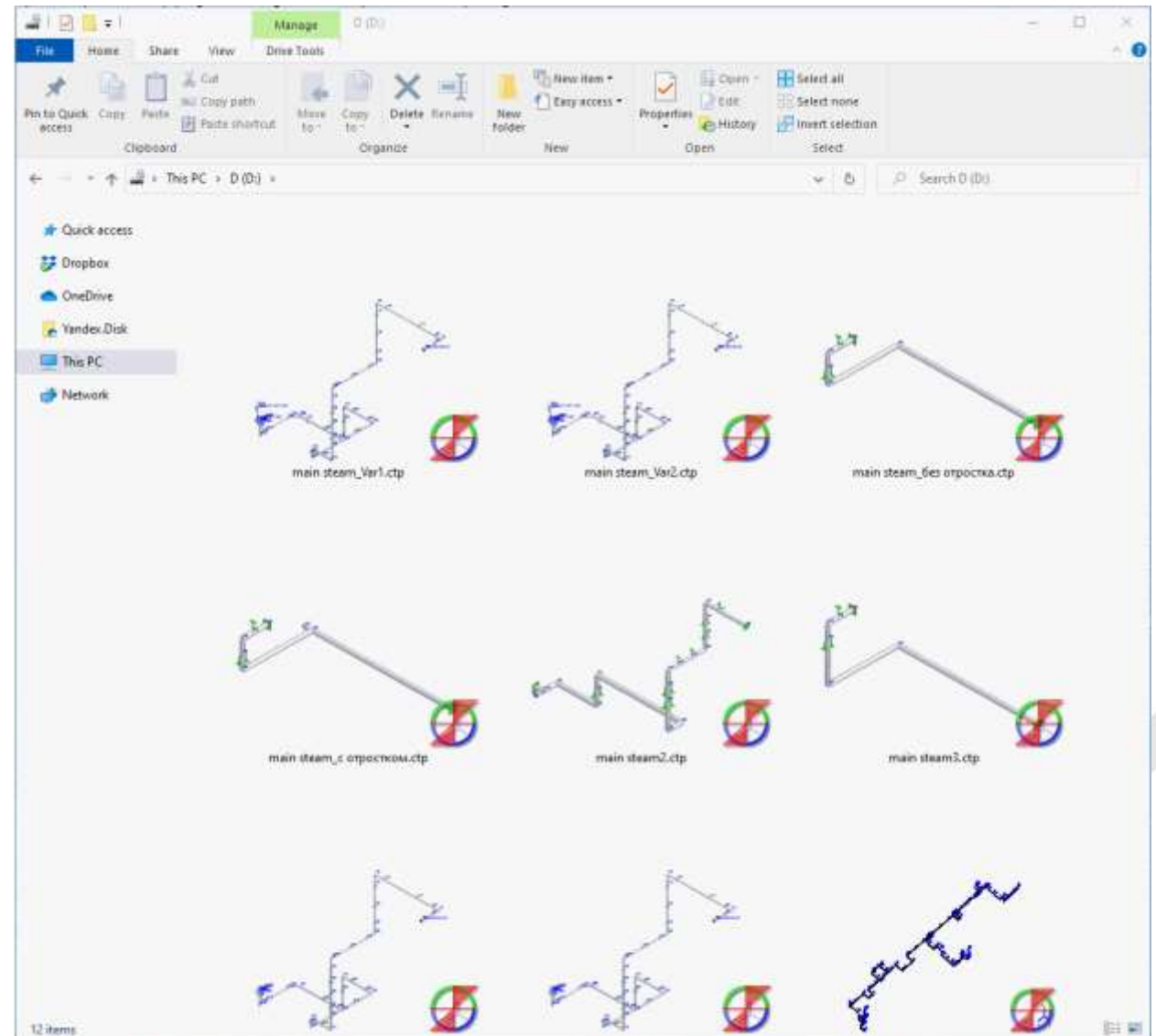


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# PASS/Start-Prof | Características

- Cada Proyecto se guarda en un solo archivo
- Capacidad de ver en miniaturas el modelo dentro del Explorador de Windows. Ahora se pueden ver todos los modelos antes de abrir el archivo.
- Abre rápidamente archivos grandes
- Alta velocidad para el análisis de esfuerzos en modelos realmente grandes



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# PASS/Start-Prof | Confiabilidad

Manual completo de Validación y Verificación. Incluye muchos ejemplos de verificación, comparación contra cálculos manuales y contra otro software.

**START-PROF model 1848**

**START-PROF model - 320571**

**CAESAR II model 1848**

**CAESAR II model - 320571**

**1.6 ASME B31.3 Appendix S (S302)**  
ASME B31.3-2018 Appendix S (S302) Model  
**Figure S302.1 Liftoff Model**

12.2 m	3.05 m	9.15 m	9.15 m	3.05 m	12.2 m
(40 ft)	(10 ft)	(30 ft)	(30 ft)	(10 ft)	(40 ft)

6.1 m (20 ft)

START-PROF model

**START-PROF model NRG1**

**START-PROF model NRG4-1**

**PASS START-PROF**  
Pipe Stress Analysis Software

**VERIFICATION AND VALIDATION MANUAL**  
Version 4.84

July 2020

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# PASS/Start-Prof | Confiabilidad

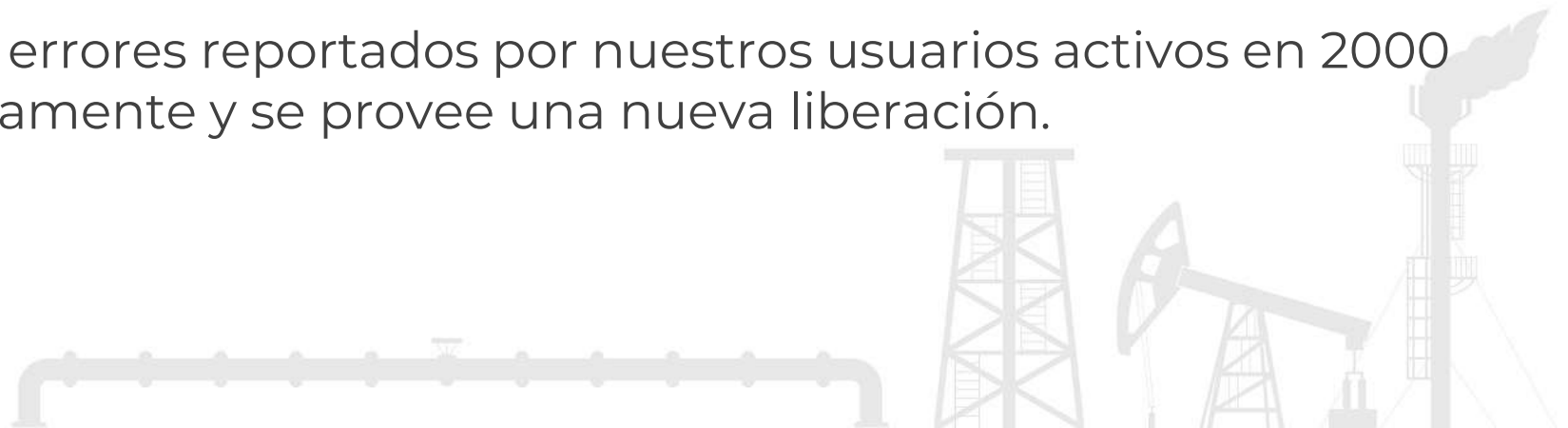
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Cada nueva versión de PASS/START-PROF es:

- Verificada automáticamente en más de 300 ejemplos con versiones previas (Sistema de aseguramiento de Calidad)
- Verificada manualmente por un grupo de expertos en análisis de esfuerzos en la tubería (testers)
- Cada versión pasa por 1 a 3 entrenamientos de análisis de esfuerzos en la tubería con 10 a 20 estudiantes antes de su liberación oficial.
- Tras la liberación, todos los errores reportados por nuestros usuarios activos en 2000 empresas se reparan rápidamente y se provee una nueva liberación.



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# PASS/Start-Prof | Licenciamiento

## Configurations/Pricing Options

<p><b>PASS/Start-Prof Complete Advanced</b></p> <p>Simulation and sizing for any piping network considering all applicable national codes.</p> <p><b>PASS/Start-Prof Complete Standard</b></p> <p>configuration includes only worldwide popular standarts.</p>	<p><b>PASS/Start-Prof Process Advanced</b></p> <p>Simulation and sizing for piping networks based on applicable national codes for process plants as well as for gas and oil transportation systems.</p> <p><b>PASS/Start-Prof Process Standard</b></p> <p>configuration includes only worldwide popular standarts.</p>	<p><b>PASS/Start-Prof Power Advanced</b></p> <p>Simulation and sizing for any piping networks based on applicable national codes for power generation piping as well as for central heating networks.</p> <p><b>PASS/Start-Prof Power Standard</b></p> <p>configuration includes only worldwide popular standarts.</p>	<p><b>PASS/START-PROF HDPE+FRP</b></p> <p>Piping stress analysis of high density polyethylene and/or fiberglass reinforced plastic piping systems.</p>
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## Configurations Comparison

Code	Complete Advanced	Process Advanced	Power Advanced	Complete Standard (40% discount)	Process Standard (40% discount)	Power Standard (40% discount)	HDPE+FRP (40% discount)
ISO 14692	✓	✓	✓				✓
HDPE Piping	✓	✓	✓				✓
ASME B31.1	✓		✓	✓		✓	
ASME B31.3	✓	✓		✓	✓		
ASME B31.4	✓	✓		✓	✓		
ASME B31.5	✓	✓	✓	✓	✓	✓	
ASME B31.8	✓	✓		✓	✓		
ASME B31.9	✓	✓	✓	✓	✓	✓	
EN 13480	✓	✓	✓	✓	✓	✓	
GB 50316	✓	✓	✓	✓	✓		
GB/T 20801	✓	✓		✓	✓		
GB 50251	✓	✓		✓	✓		
GB 50253	✓	✓		✓	✓		
DL/T 5366	✓		✓	✓		✓	
CJJ/T 81	✓		✓				
RD 10-249-98	✓		✓				
GOST R 55596	✓		✓				
GOST 32388	✓	✓					
SNIP 2.05.06-85	✓	✓					
SP 36.13330	✓	✓					



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# PASS/Start-Prof | Recursos

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- Facebook [www.facebook.com/PASSuite](http://www.facebook.com/PASSuite)
- Twitter [twitter.com/passuitecom](http://twitter.com/passuitecom)
- Más de 50 artículos acerca de análisis de esfuerzos en la tubería y funciones en PASS/START-PROF <https://whatispiping.com/category/start-prof>



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# PASS/Start-Prof | Resources

Suscríbese al canal de YouTube, encontrará muchos vídeos de entrenamiento en PASS/START-PROF

[www.youtube.com/passuite](http://www.youtube.com/passuite)

The screenshot displays the YouTube channel page for 'PASS', which has 716 subscribers. The page is organized into a grid of video uploads. Each video thumbnail includes a title, a duration, and view/viewer statistics. The videos cover a wide range of topics related to piping and equipment analysis, including software overviews, tutorials, and case studies. The channel navigation bar includes links for HOME, VIDEOS, PLAYLISTS, CHANNELS, DISCUSSION, and ABOUT. A 'SUBSCRIBED' button and a notification bell are visible in the top right corner.

Video Title	Duration	Views / Time Ago
PASS/EQUIP Overview Webinar: Comprehensive...	49:33	124 views • 4 days ago
PASS/START-PROF Overview Webinar: Your software for...	1:10:09	334 views • 2 months ago
PASS/EQUIP Nozzle-FEM Overview Webinar: Powerful...	25:50	135 views • 2 months ago
How to Import piping model from CADWorx to START-...	3:14	193 views • 2 months ago
Pipe Stress Analysis Software: How to Import Piping Model from CADWorx to START-PROF Method 1: Using PCF file	1:50	119 views • 2 months ago
PASS/HYDROSYSTEM Overview Webinar: Comprehensive Overview for Pipe-to-Pipe, 2-Way and 3-Way Connections	1:14:54	229 views • 3 months ago
PASS/START-PROF was used for 2022 Winter Olympic...	0:50	162 views • 4 months ago
Beijing Universal Amusement Park Buried Hot Water Pipin...	2:00	261 views • 4 months ago
PASS/START-PROF Overview Webinar: Your software for...	9:35	196 views • 5 months ago
New START-PROF option: Import from Autodesk Revit	1:53	370 views • 6 months ago
18 How to calculate the 'slurry' flow in Hydrosystem	1:42	111 views • 9 months ago
17 How to calculate the gas liquid liquid flow in...	3:48	134 views • 9 months ago
How to import PCF file to START PROF	2:23	365 views • 1 year ago
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Pipe Stress Analysis From Water Hammer Loads	10:36	2.2K views • 1 year ago
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Big Piping Model Analysis Tutorial with PASS/START-...	2:27	1.4K views • 1 year ago
GRP / GRE / FRP Piping Stress Analysis Tutorial usi...	8:27	
HDPE Piping Stress Analysis Tutorial With PASS/START-...	4:07	
HDPE Piping Stress Analysis With PASS/START-PROF...	13:06	
Two-way integration between PASS/Start-Prof Pipe Stress...	3:25	
16 Interface between Hydrosystem and START-...	2:30	
Buried Piping/Pipelines Stress Analysis with...	26:21	



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# Thank YOU!