Pipe Support Design Process

Taking Advantage of Technology

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Dan Klawonn

Pipe Support Design Process

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Topics Presented

- LISEGA general information
- Pipe Support Engineering Design Process
- Walk Through an Example of Pipe Support Design Process
- Utilizing Caesar Output to Generate Pipe Support Design Data
- Manual Selection of Spring Hanger Assembly Requirements
- LICAD – A State of Art Pipe Support Design Tool Demonstration
- Export LICAD information to 2D & 3D Platforms
- Question and Answers

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LISEGA General Information

- Founded in 1964 by Gerhard Liesegang
- Largest Pipe Hanger Company Worldwide
- Numerous International Fabrication locations
- Predominant Supplier in the Power Market – Fossil & Nuclear
- Distribution began in 1987 from Laconia, New Hampshire
- Manufacturing began in Newport, Tennessee in late 1993
- Moved to new facility in Kodak, Tennessee in March 2011

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LISEGA General Information

	LISEGA Group	LISEGA AG Germany	LISEGA Inc. USA	LISEGA Ltd. UK	LISEGA PST China	LISEGA SAS France	Mürmann GmbH Germany
Locations	LISEGA						
Output in Tons.[1)]	26,400	11,550	5,720	660	5,940	880	1,650
Employees [2)] • Total • Shop	 961 588	 466 281	 155 85	 18 7	 216 166	 48 30	 29 19
Areas • Total • Shop • Office • Outside	 1,686,092 ft² 419,640 ft² 66,712 ft² 1,199,740 ft²	 645,600 ft² 215,200 ft² 32,280 ft² 398,120 ft²	 622,000 ft² 100,000 ft² 22,000 ft² 500,000 ft²	 34,432 ft² 10,760 ft² 2,152 ft² 21,520 ft²	 398,120 ft² 75,320 ft² [3)] 10,760 ft² 312,040 ft²	 32,280 ft² 21,520 ft² 5,380 ft² 5,380 ft²	 112,980 ft² 21,520 ft² 5,380 ft² 86,080 ft²

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LISEGA Facility in Kodak, TN

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LISEGA Facility in Kodak, TN

22,000 ft² Office Space

100,000 ft² Manufacturing Space

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LISEGA Facility in Kodak, TN

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LISEGA Facility in Kodak, TN

CNC Plasma Torch. (Note that steel plates load directly onto table by forklift from outside)

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LISEGA Facility in Kodak, TN

4-head oxy-acetylene Torch. (Both CNC & Oxy torches are controlled by a single operator)

LISEGA

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LISEGA Facility in Kodak, TN

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in

Petro-Chemical Industry

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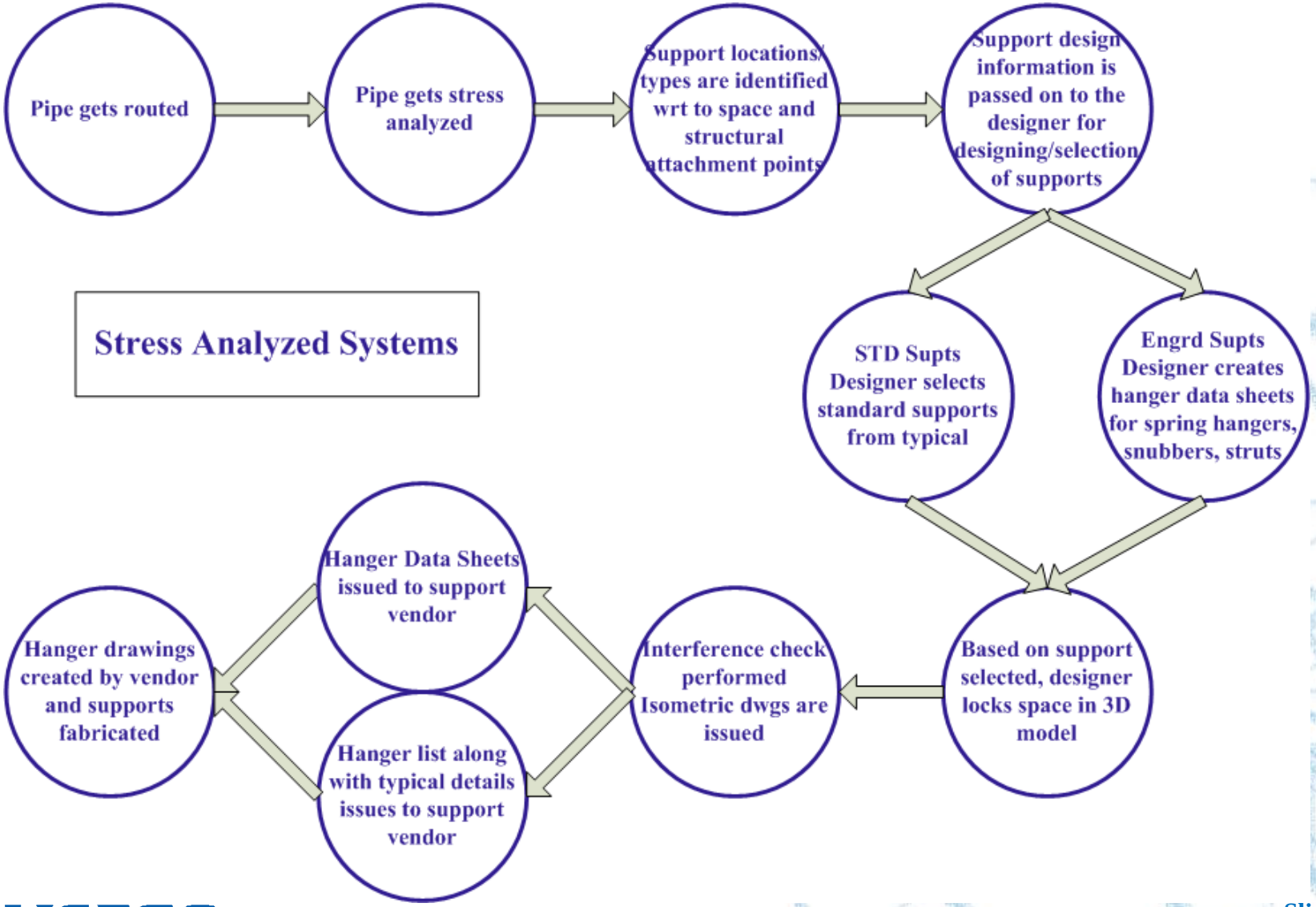

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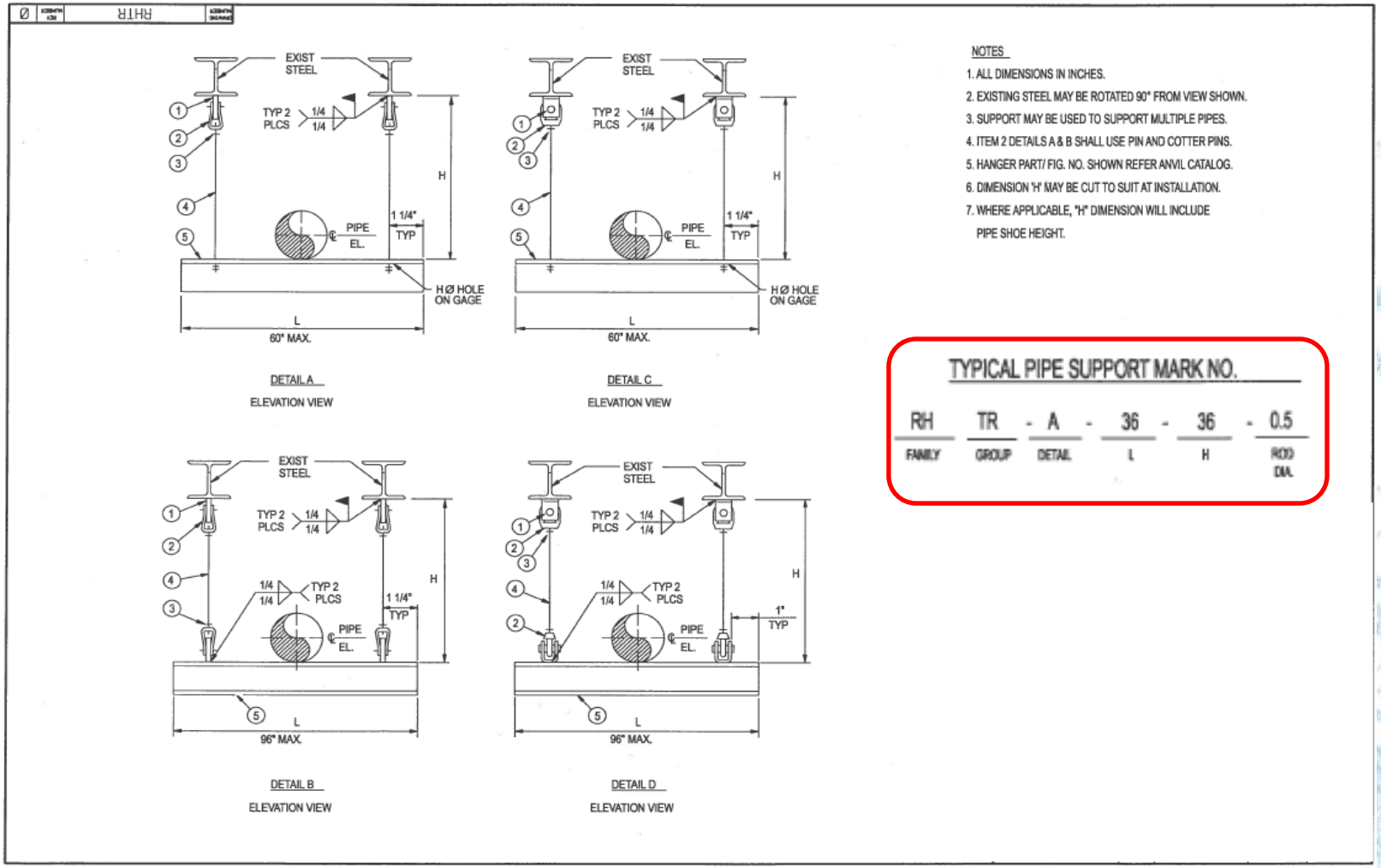
Sample of Typical Support Drawing



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Sample Typical Bill of Quantity

DETAIL A							
PIPE SIZE (in)	ROD SIZE (in)	ITEM NO.1 FIG. NO. 2 REQ'D	ITEM NO.2 FIG. NO. 2 REQ'D	ITEM NO.3 6 REQ'D	ITEM NO.4 FIG. NO. 2 REQ'D	ITEM NO.5 BEAM 1 REQ'D	HØ HOLE (in)
1/2	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	L4x4x3/8	5/8
3/4	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	L4x4x3/8	5/8
1	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	L4x4x3/8	5/8
1 1/2	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	L4x4x3/8	5/8
2	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	L4x4x3/8	5/8
2 1/2	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	L4x4x3/8	5/8
3	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	L4x4x3/8	5/8
4	5/8	FIG. 55	FIG. 299	HEX NUT	FIG. 146	L4x4x3/8	3/4
6	3/4	FIG. 55	FIG. 299	HEX NUT	FIG. 146	L6x6x3/8	7/8
8	3/4	FIG. 55	FIG. 299	HEX NUT	FIG. 146	L6x6x3/8	7/8

DETAIL C							
PIPE SIZE (in)	ROD SIZE (in)	ITEM NO.1 FIG. NO. 2 REQ'D	ITEM NO.2 FIG. NO. 2 REQ'D	ITEM NO.3 6 REQ'D	ITEM NO.4 FIG. NO. 2 REQ'D	ITEM NO.5 BEAM 1 REQ'D	HØ HOLE (in)
1/2	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	L4x4x3/8	5/8
3/4	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	L4x4x3/8	5/8
1	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	L4x4x3/8	5/8
1 1/2	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	L4x4x3/8	5/8
2	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	L4x4x3/8	5/8
2 1/2	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	L4x4x3/8	5/8
3	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	L4x4x3/8	5/8
4	5/8	FIG. 66	FIG. 290	HEX NUT	FIG. 146	L4x4x3/8	3/4
6	3/4	FIG. 66	FIG. 290	HEX NUT	FIG. 146	L6x6x3/8	7/8
8	3/4	FIG. 66	FIG. 290	HEX NUT	FIG. 146	L6x6x3/8	7/8

TYPICAL PIPE SUPPORT MARK NO.

RH	TR	- A -	36	- 36	- 0.5
FAMILY	GROUP	DETAIL	L	H	ROD DIA.

DETAIL B						
PIPE SIZE (in)	ROD SIZE (in)	ITEM NO.1 FIG. NO. 4 REQ'D	ITEM NO.2 FIG. NO. 4 REQ'D	ITEM NO.3 4 REQ'D	ITEM NO.4 FIG. NO. 2 REQ'D	ITEM NO.5 1 REQ'D
1/2	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	W4 X 13
3/4	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	W4 X 13
1	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	W4 X 13
1 1/2	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	W4 X 13
2	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	W4 X 13
2 1/2	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	W4 X 13
3	1/2	FIG. 55	FIG. 299	HEX NUT	FIG. 146	W4 X 13
4	5/8	FIG. 55	FIG. 299	HEX NUT	FIG. 146	W4 X 13
6	3/4	FIG. 55	FIG. 299	HEX NUT	FIG. 146	W6 X 15
8	3/4	FIG. 55	FIG. 299	HEX NUT	FIG. 146	W6 X 15
10	1	FIG. 55	FIG. 299	HEX NUT	FIG. 146	W6 X 15
12	1	FIG. 55	FIG. 299	HEX NUT	FIG. 146	W6 X 15

DETAIL D						
PIPE SIZE (in)	ROD SIZE (in)	ITEM NO.1 FIG. NO. 4 REQ'D	ITEM NO.2 FIG. NO. 4 REQ'D	ITEM NO.3 4 REQ'D	ITEM NO.4 FIG. NO. 2 REQ'D	ITEM NO.5 1 REQ'D
1/2	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	W4 X 13
3/4	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	W4 X 13
1	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	W4 X 13
1 1/2	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	W4 X 13
2	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	W4 X 13
2 1/2	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	W4 X 13
3	1/2	FIG. 66	FIG. 290	HEX NUT	FIG. 146	W4 X 13
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6	3/4	FIG. 66	FIG. 290	HEX NUT	FIG. 146	W6 X 15
8	3/4	FIG. 66	FIG. 290	HEX NUT	FIG. 146	W6 X 15
10	1	FIG. 66	FIG. 290	HEX NUT	FIG. 146	W6 X 15
12	1	FIG. 66	FIG. 290	HEX NUT	FIG. 146	W6 X 15

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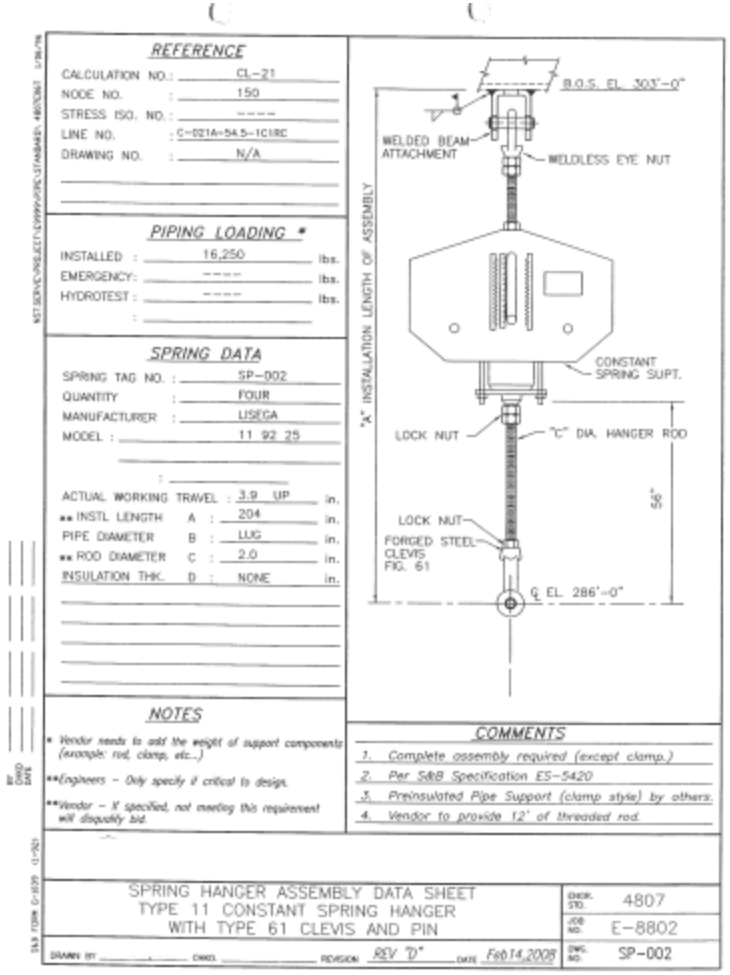
Sample Support Data Sheets



REFERENCE

CALCULATION NO.: CL-21
NODE NO. : 150
STRESS ISO. NO. : ----
LINE NO. : C-021A-54.5-1C1RC
DRAWING NO. : N/A

PIPING LOADING *

INSTALLED : 16,250 lbs.
EMERGENCY: ---- lbs.
HYDROTEST : ---- lbs.

SPRING DATA

SPRING TAG NO. : SP-002
QUANTITY : FOUR
MANUFACTURER : LISEGA
MODEL : 11 92 25

ACTUAL WORKING TRAVEL : 3.9 UP in.
** INSTL LENGTH A : 204 in.
PIPE DIAMETER B : LUG in.
** ROD DIAMETER C : 2.0 in.
INSULATION THK. D : NONE in.

NOTES

* Vendor needs to add the weight of support components (example: rod, clamp, etc..)
**Engineers – Only specify if critical to design.
**Vendor – If specified, not meeting this requirement will disqualify bid.

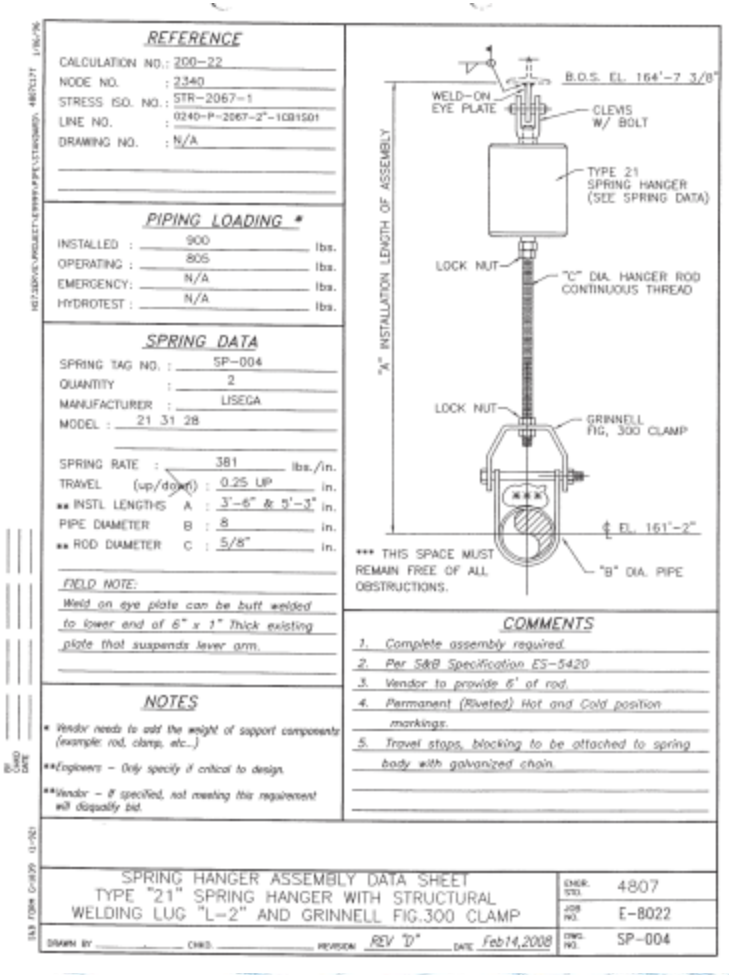
COMMENTS

1. Complete assembly required (except clamp.)
2. Per S&B Specification ES-5420
3. Preinsulated Pipe Support (clamp style) by others.
4. Vendor to provide 12' of threaded rod.

SPRING HANGER ASSEMBLY DATA SHEET
TYPE 11 CONSTANT SPRING HANGER
WITH TYPE 61 CLEVIS AND PIN

DRAWN BY ____ CHKD. ____ REVISION REV "D" DATE Feb14,2008

ENGR. STD. 4807
JOB NO. E-8802
DWG. NO. SP-002



REFERENCE

CALCULATION NO.: 200-22
NODE NO. : 2340
STRESS ISO. NO. : STR-2067-1
LINE NO. : 0240-P-2067-2"-1C01S01
DRAWING NO. : N/A

PIPING LOADING *

INSTALLED : 900 lbs.
OPERATING : 805 lbs.
EMERGENCY: N/A lbs.
HYDROTEST : N/A lbs.

SPRING DATA

SPRING TAG NO. : SP-004
QUANTITY : 2
MANUFACTURER : LISEGA
MODEL : 21 31 28

SPRING RATE : 381 lbs./in.
TRAVEL (up/down) : 0.25 UP in.
** INSTL LENGTHS A : 3'-6" & 5'-3" in.
PIPE DIAMETER B : 8 in.
** ROD DIAMETER C : 5/8" in.

FIELD NOTE:
Weld on eye plate can be butt welded to lower end of 6" x 1" Thick existing plate that suspends lever arm.

NOTES

* Vendor needs to add the weight of support components (example: rod, clamp, etc..)
**Engineers – Only specify if critical to design.
**Vendor – If specified, not meeting this requirement will disqualify bid.

COMMENTS

1. Complete assembly required.
2. Per S&B Specification ES-5420
3. Vendor to provide 6' of rod.
4. Permanent (Riveted) Hot and Cold position markings.
5. Travel stops, blocking to be attached to spring body with galvanized chain.

SPRING HANGER ASSEMBLY DATA SHEET
TYPE "21" SPRING HANGER WITH STRUCTURAL
WELDING LUG "L-2" AND GRINNELL FIG.300 CLAMP

DRAWN BY ____ CHKD. ____ REVISION REV "D" DATE Feb14,2008

ENGR. STD. 4807
JOB NO. E-8022
DWG. NO. SP-004

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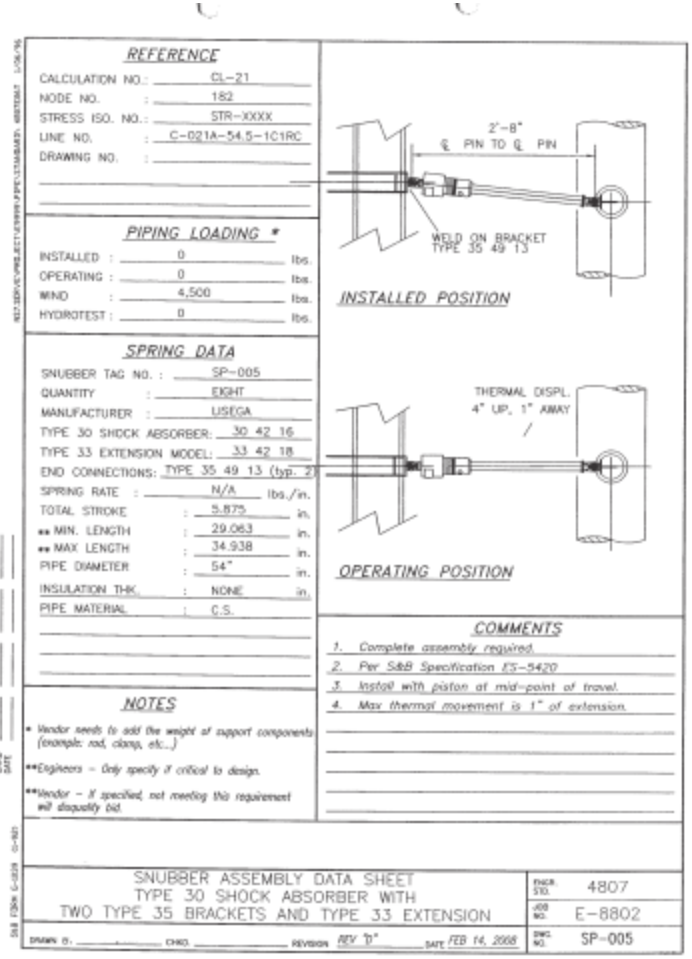
Sample Support Data Sheets



REFERENCE

CALCULATION NO.: CL-21
NODE NO. : 182
STRESS ISO. NO.: STR-XXXX
LINE NO. : C-021A-54.5-1C1RC
DRAWING NO. :

PIPING LOADING *

INSTALLED :	0	lbs.
OPERATING :	0	lbs.
WIND :	4,500	lbs.
HYDROTEST :	0	lbs.

SPRING DATA

SNUBBER TAG NO. :	SP-005	
QUANTITY :	EIGHT	
MANUFACTURER :	LISEGA	
TYPE 30 SHOCK ABSORBER:	30 42 16	
TYPE 33 EXTENSION MODEL:	33 42 18	
END CONNECTIONS:	TYPE 35 49 13 (typ. 2)	
SPRING RATE :	N/A	lbs./in.
TOTAL STROKE :	5.875	in.
** MIN. LENGTH :	29.063	in.
** MAX LENGTH :	34.938	in.
PIPE DIAMETER :	54"	in.
INSULATION THK. :	NONE	in.
PIPE MATERIAL :	C.S.	

2'-8" ℄ PIN TO ℄ PIN

WELD ON BRACKET TYPE 35 49 13

INSTALLED POSITION

THERMAL DISPL. 4" UP, 1" AWAY

OPERATING POSITION

COMMENTS

1. Complete assembly required.
2. Per S&B Specification ES-5420
3. Install with piston at mid-point of travel.
4. Max thermal movement is 1" of extension.

NOTES

* Vendor needs to add the weight of support components (example: rod, clamp, etc...)

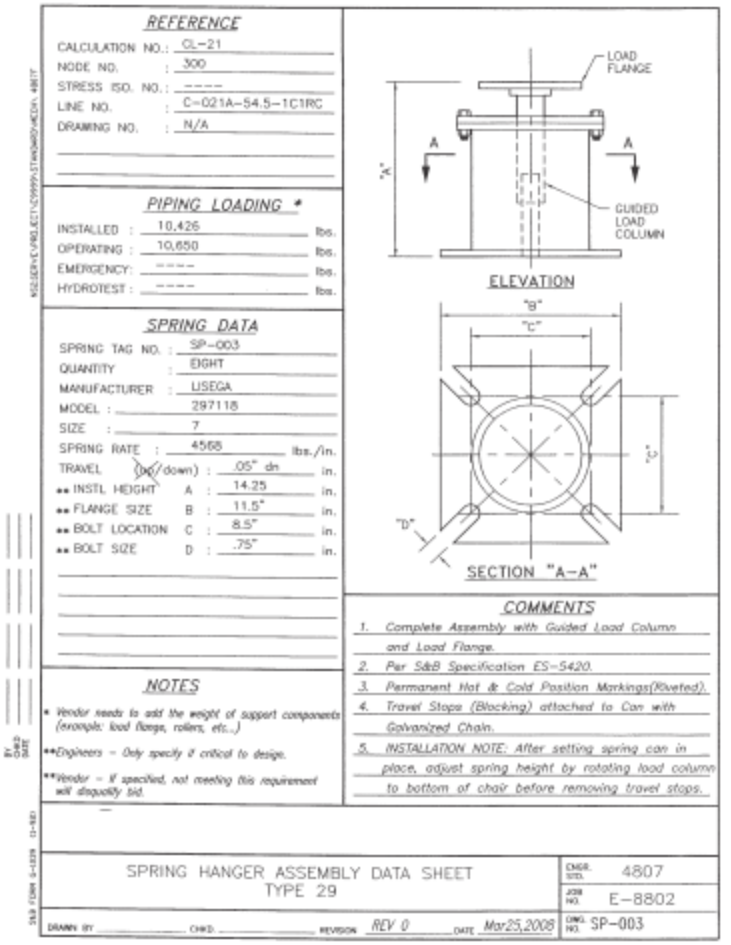
**Engineers - Only specify if critical to design.

**Vendor - If specified, not meeting this requirement will disqualify bid.

SNUBBER ASSEMBLY DATA SHEET
TYPE 30 SHOCK ABSORBER WITH
TWO TYPE 35 BRACKETS AND TYPE 33 EXTENSION

ENGR. STD. 4807
JOB NO. E-8802
DWG. NO. SP-005

DRAWN B. CHKD. REVISION REV "0" DATE FEB 14, 2008



REFERENCE

CALCULATION NO.: CL-21
NODE NO. : 300
STRESS ISO. NO.: ----
LINE NO. : C-021A-54.5-1C1RC
DRAWING NO. : N/A

PIPING LOADING *

INSTALLED :	10,426	lbs.
OPERATING :	10,650	lbs.
EMERGENCY:	----	lbs.
HYDROTEST :	----	lbs.

SPRING DATA

SPRING TAG NO. :	SP-003	
QUANTITY :	EIGHT	
MANUFACTURER :	LISEGA	
MODEL :	297118	
SIZE :	7	
SPRING RATE :	4568	lbs./in.
TRAVEL (up/down) :	.05" dn	in.
** INSTL HEIGHT A :	14.25	in.
** FLANGE SIZE B :	11.5"	in.
** BOLT LOCATION C :	8.5"	in.
** BOLT SIZE D :	.75"	in.

LOAD FLANGE

GUIDED LOAD COLUMN

ELEVATION

SECTION "A-A"

COMMENTS

1. Complete Assembly with Guided Load Column and Load Flange.
2. Per S&B Specification ES-5420.
3. Permanent Hot & Cold Position Markings(Riveted).
4. Travel Stops (Blocking) attached to Can with Galvanized Chain.
5. INSTALLATION NOTE: After setting spring can in place, adjust spring height by rotating load column to bottom of chair before removing travel stops.

NOTES

* Vendor needs to add the weight of support components (example: load flange, rollers, etc...)

**Engineers - Only specify if critical to design.

**Vendor - If specified, not meeting this requirement will disqualify bid.

SPRING HANGER ASSEMBLY DATA SHEET
TYPE 29

ENGR. STD. 4807
JOB NO. E-8802
DWG. NO. SP-003

DRAWN BY CHKD. REVISION REV 0 DATE Mar25,2008

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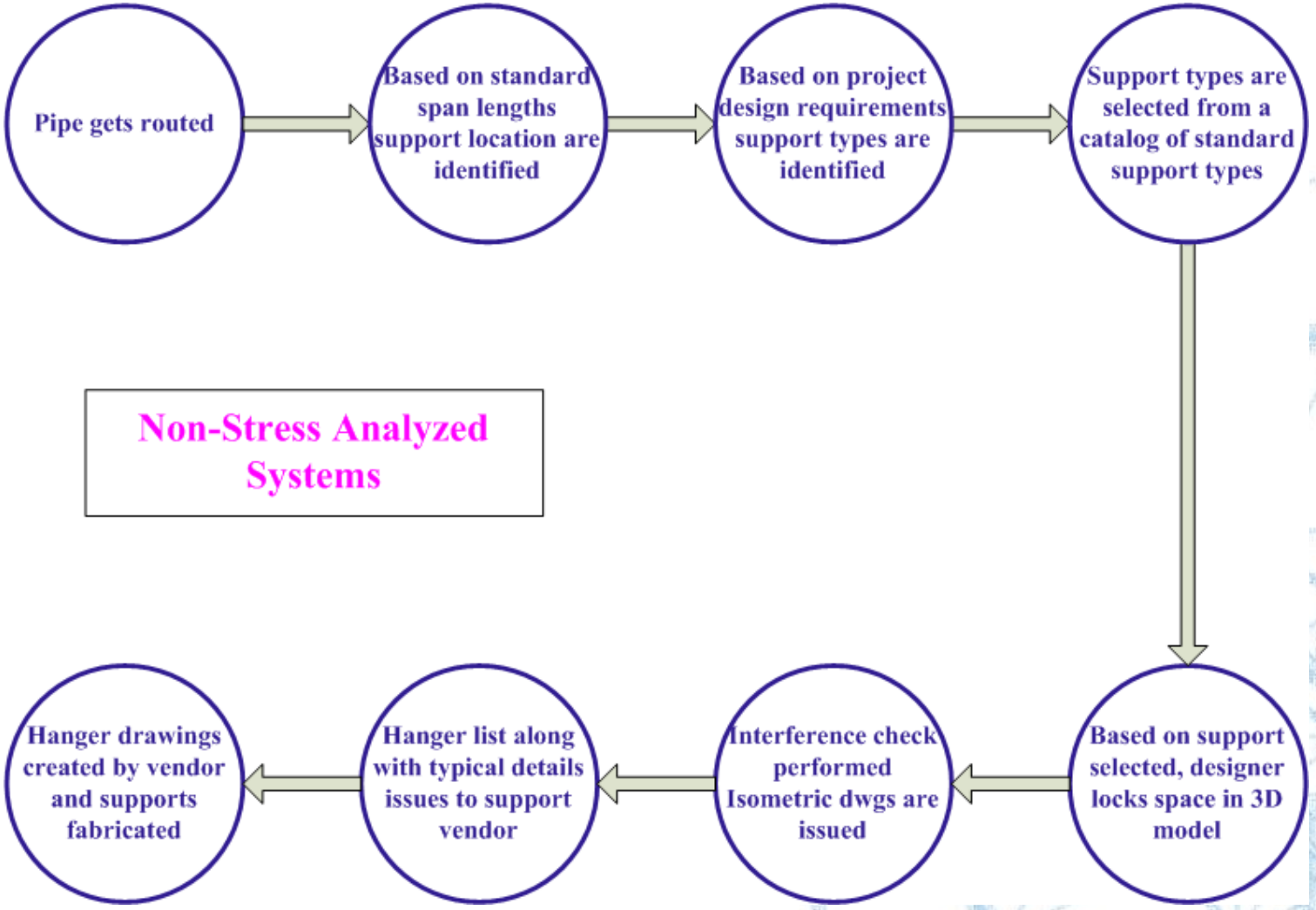

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Solution for the Design of a Support Hanger Assembly

- Need a software that would perform the following functions:
  - Design of support assemblies in terms of load capacities, compatibility of components and space restrictions
  - Drafting of support assemblies with complete BOM, detailed data for setting springs in the shop, installation details in terms of field welds, offsets, location of supports etc.
  - Populating of support assembly in 3D environment with exact dimensions and not blocking of arbitrary spaces

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Savings can be Realized by Utilizing Hanger Design Tool LICAD

- Total design hours in designing individual supports for the project
- Total drafting hours for individual support assemblies
- Total modeling hours for locating supports in 3D model and performing interference checks
- Simple and consistent designs save hours in designing, fabrication and installation of supports
- Overall total man hours (schedule) are reduced thereby assuring minimal cost over runs and assured Pipe Support deliveries to site

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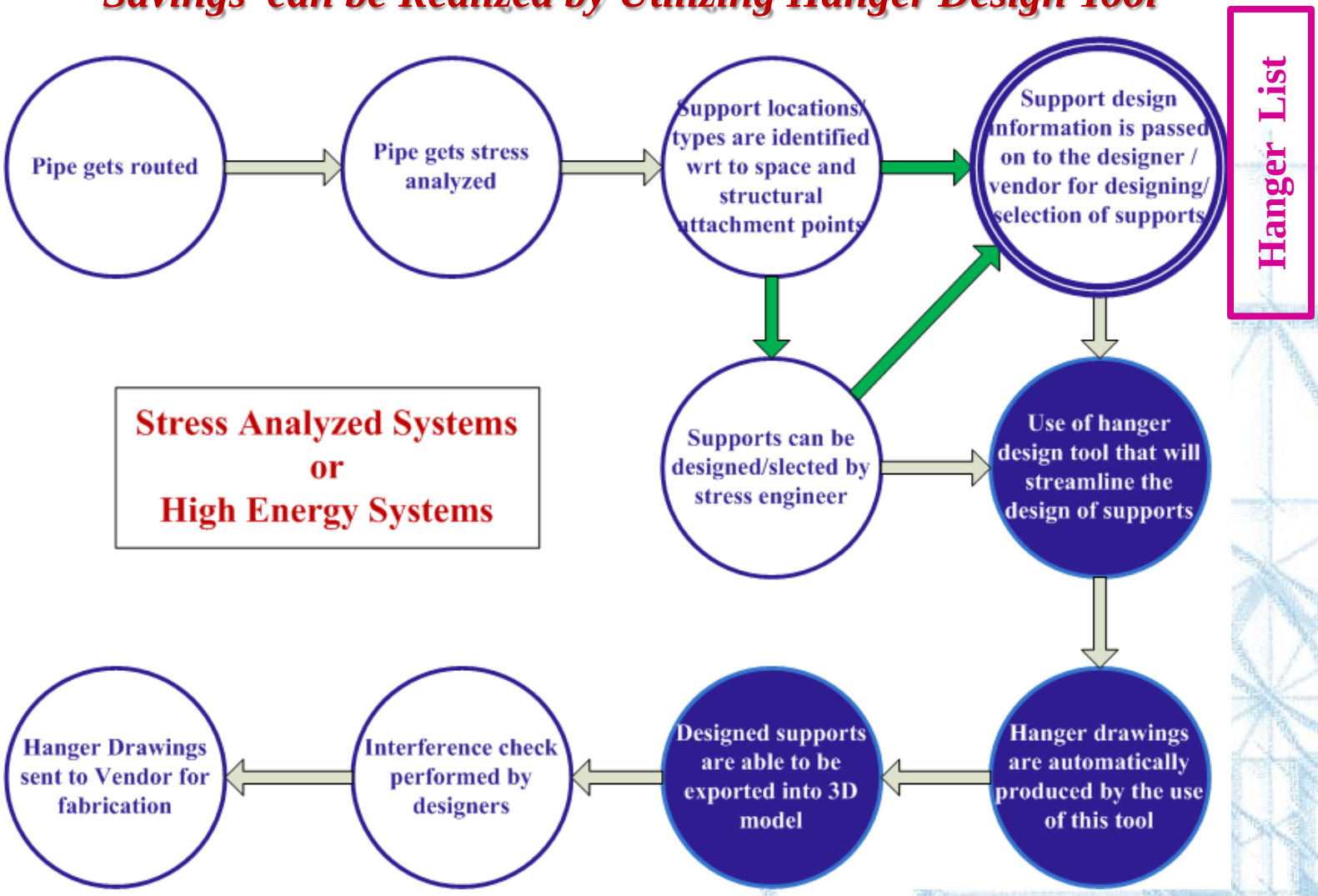
Savings can be Realized by Utilizing Hanger Design Tool



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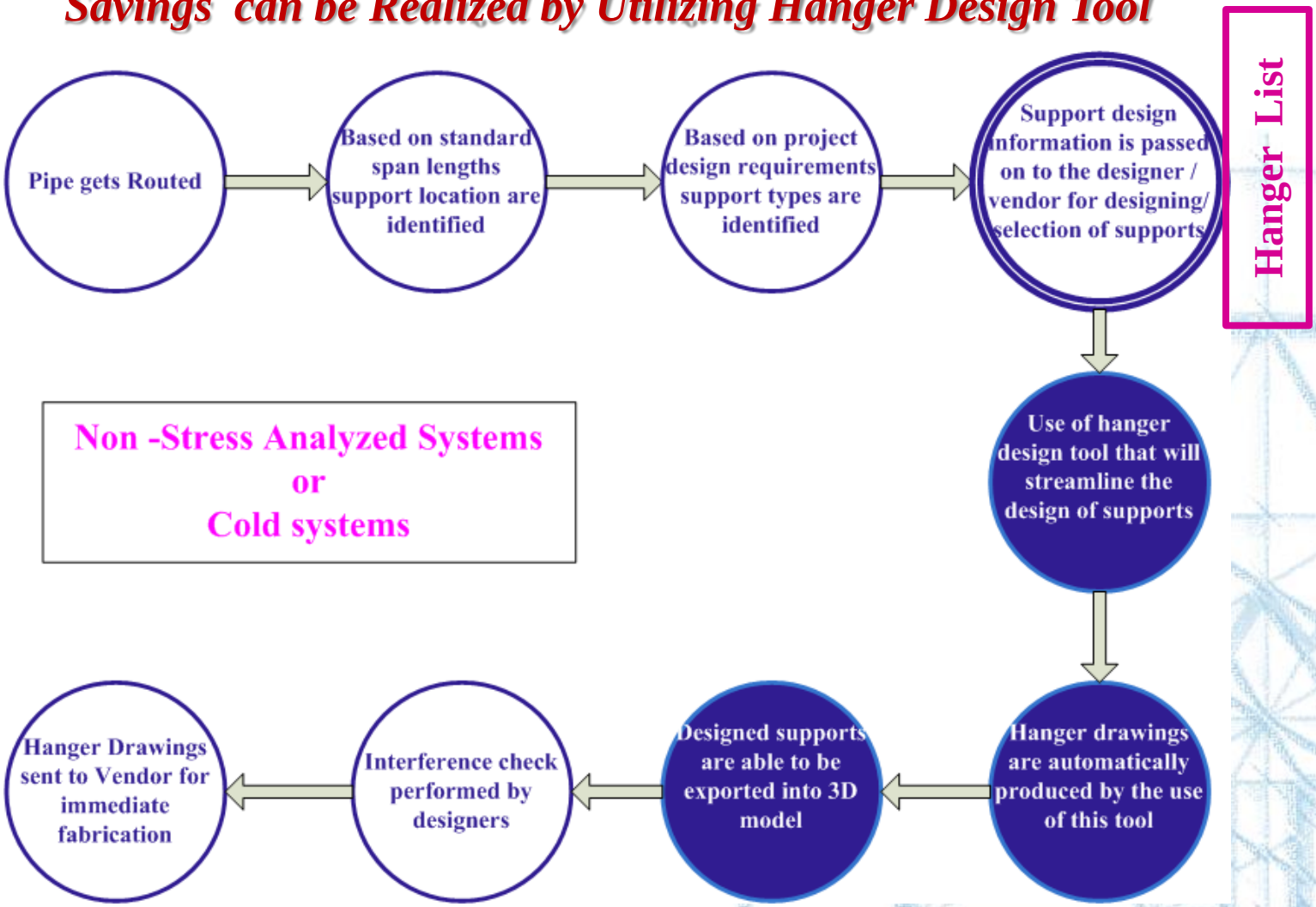
Savings can be Realized by Utilizing Hanger Design Tool



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Example of Pipe Support Design Process

- Pipe has been routed
- Piping layout handed over to Piping Engineer for qualifying the piping system to meet B31.3 or B31.1 code requirements and to come up with supporting scheme that meets these requirements
- Caesar II program is utilized to (stress) analyze the piping system
- Support types and locations are part of geometry input into Caesar and supports get selected in Caesar model to qualify the system

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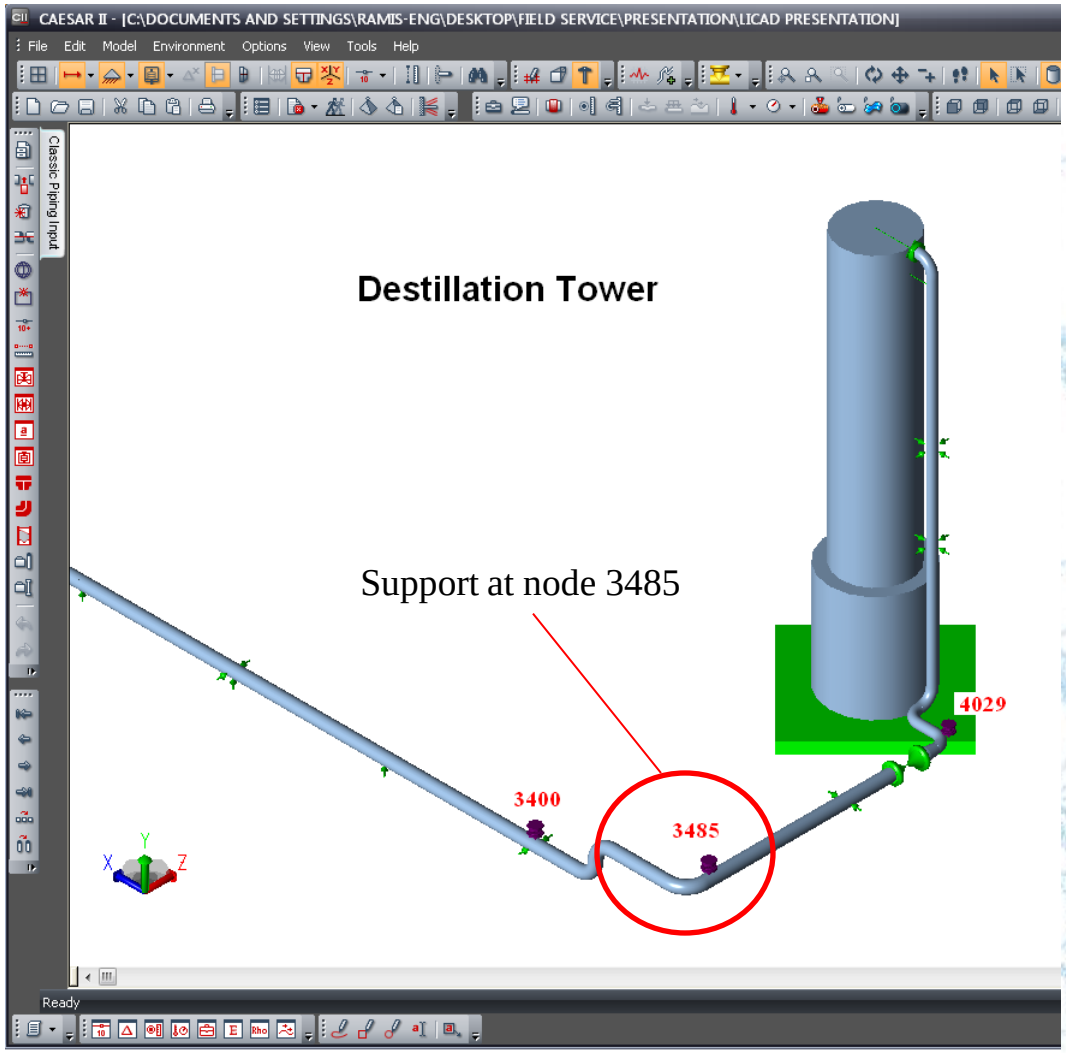
Example of Caesar Model and Supports Selected

- Support at node 3485 is a spring hanger and can be modeled as
  - Top supported close to the beam
  - Top Supported with spring can in the middle to avoid interference
  - Top supported Trapeze due to limited head room
  - Bottom supported spring can



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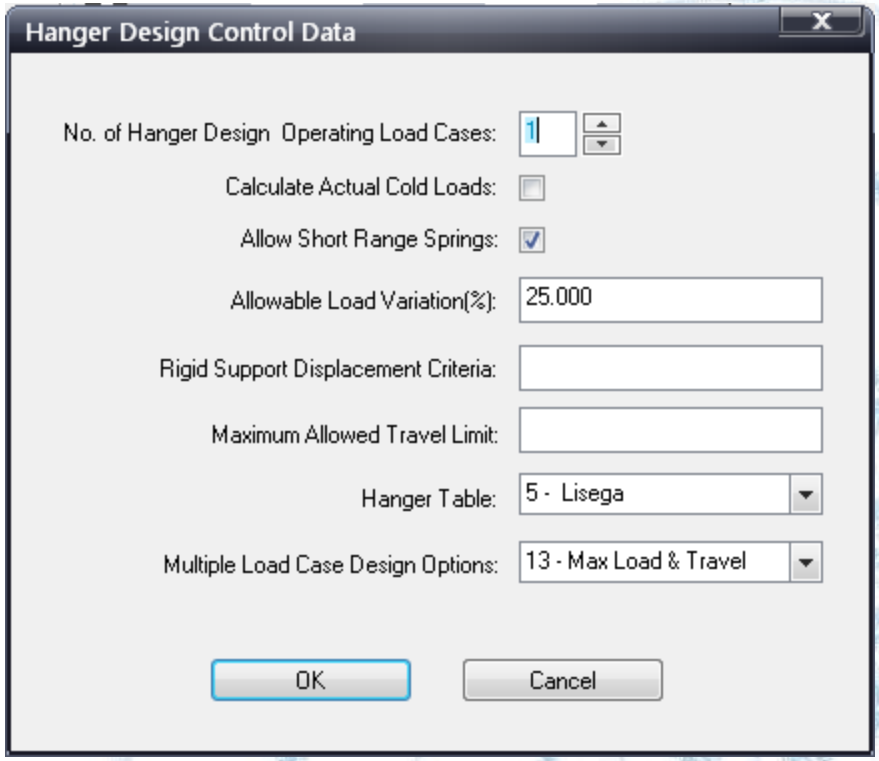
Example of Caesar Model and Supports Selected

Selection of Spring Hangers within Caesar

- Caesar has a built-in Lisega variable and constant hanger library (as well as other vendors suppliers)
- Hanger Design Control Data form is utilized for selection of springs within Caesar to apply to the entire system. Some parameters used for this are:
  - Allowable Load Variation
  - Hanger Table : 5 – Lisega
  - Multiple Load case Design Options
  - Etc.



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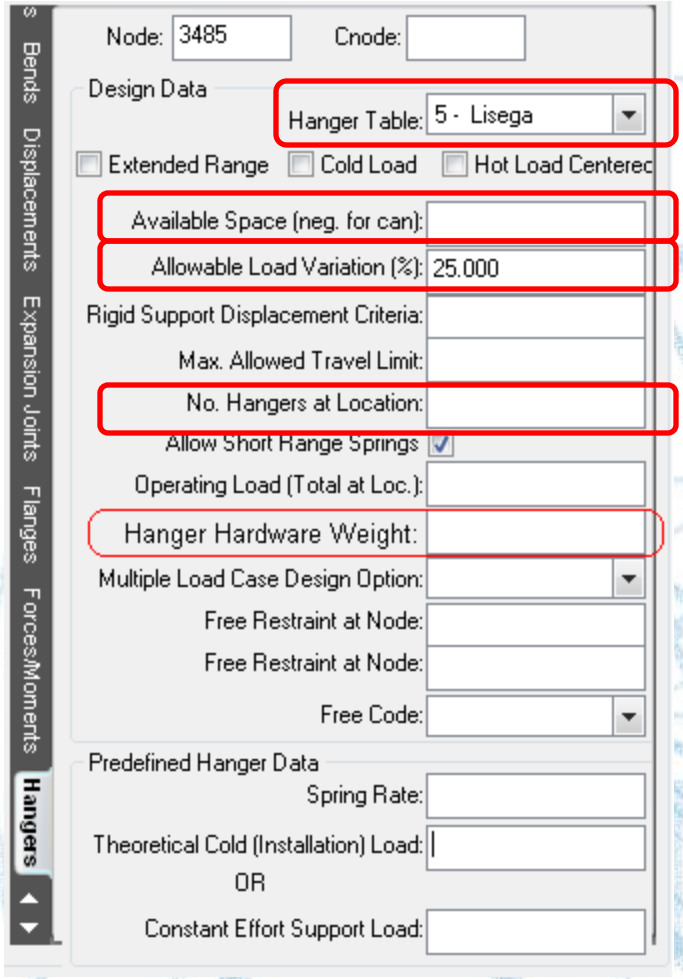
Example of Caesar Input Spring Hanger Selection

Selection of Spring Hangers within Caesar II

- Selection of springs within Caesar on an individual basis is carried out by selecting the following:

  - Hanger Table : 5 – Lisega
  - Available Space
  - Allowable Load Variation
  - No. Hangers at Location
  - Hanger hardware weight (tare weight) input field to correctly pick the right size of spring



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Example of Caesar Output Hanger Load Summary

LOAD CASE DEFINITION KEY

CASE 4 (OPE) W+T1+P1+H
CASE 5 (SUS) W+P1+H
CASE 6 (EXP) L6=L4-L5

NODE	Load Case	FX lb.	FY lb.	FZ lb.	MX ft.lb.	MY ft.lb.	MZ ft.lb.	DX in.	DY in.	DZ in.
3485		Prog Design	VSH							
	4(OPE)	0	-5383	0	0	0	0	-2.7455	-0.4422	0.4595
	5(SUS)	0	-5266	0	0	0	0	-0.0533	-0.0450	-0.0184
	6(EXP)	0	-117	0	0	0	0	-2.6922	-0.3972	0.4779
	MAX		-5383/L4					-2.7455/L4	-0.4422/L4	0.4779/L6

Z	Axial
X	Lateral
Y	Vertical

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Example of Caesar Output Spring Hanger Selection

```
CAESAR II Ver.5.20.1,  (Build 090904)   Date: FEB 7, 2011    Time: 13:37
Job: C:\DOCUMENTS AND SETTINGS\RAMIS-ENG\DE...\LICAD PRESENTATION
Licensed To: LISEGA, INC.   --  ID #28215

 CAESAR II  HANGER REPORT          (TABLE DATA FROM DESIGN RUNS)

                                                THEORETICAL  ACTUAL
      NO.  FIG.        VERTICAL     HOT        INSTALLED   INSTALLED SPRING HORIZONTAL
 NODE REQD NO.  SIZE   MOVEMENT     LOAD         LOAD        LOAD     RATE   MOVEMENT

-------+---+-----+----+---(in.)--+--(lb.)-+--(lb.)---+--(lb.)--(lb./in.)--(in.)-
   3400   1       2161    -0.222     5420.      4743.          0.   3045.   2.037
          LISEGA                                          LOAD VARIATION =   12%
          ** VARIABLE SUPPORT SPRING DESIGNED ..................  SHORT RANGE
             MAXIMUM TABLE DISPLACEMENT RANGE ..... (in.)          7.800
             MINIMUM ALLOWED SINGLE SPRING LOAD ... (lb.)       3000.000
             MAXIMUM ALLOWED SINGLE SPRING LOAD ... (lb.)       9000.000
             RECOMMENDED INSTALLATION CLEARANCE ... (in.)          9.560
-------+---+-----+----+---------+--------+---------+---------+-------+--------
   3485   1       2162    -0.442     5383.      4710.          0.   1522.   2.784
          LISEGA                                          LOAD VARIATION =   13%
          ** VARIABLE SUPPORT SPRING DESIGNED ..................   MID RANGE
             MAXIMUM TABLE DISPLACEMENT RANGE ..... (in.)          7.800
             MINIMUM ALLOWED SINGLE SPRING LOAD ... (lb.)       3000.000
             MAXIMUM ALLOWED SINGLE SPRING LOAD ... (lb.)       9000.000
             RECOMMENDED INSTALLATION CLEARANCE ... (in.)         14.040
-------+---+-----+----+---------+--------+---------+---------+-------+--------
   4029   1       2161    -0.260     6516.      5725.          0.   3045.   2.616
          LISEGA                                          LOAD VARIATION =   12%
          ** VARIABLE SUPPORT SPRING DESIGNED ..................  SHORT RANGE
             MAXIMUM TABLE DISPLACEMENT RANGE ..... (in.)          7.800
             MINIMUM ALLOWED SINGLE SPRING LOAD ... (lb.)       3000.000
             MAXIMUM ALLOWED SINGLE SPRING LOAD ... (lb.)       9000.000
             RECOMMENDED INSTALLATION CLEARANCE ... (in.)          9.560
-------+---+-----+----+---------+--------+---------+---------+-------+--------
```

Pipe Support Design Process

Taking Advantage of Technology

LISEGA Catalog Selection of Spring Hanger

Spring hangers type 21, Spring hangers type 25, Spring supports type 29, Angulating spring supports type 20

Travel range ①					Type number										
					21 C2 29	21 D. 29	21 1. 28	21 2. 28	21 3. 28	21 4. 28	21 5. 28	21 6. 28	21 7. 28	21 8. 28	21 9. 28
						25 D. 19	25 1. 18	25 2. 18	25 3. 18	25 4. 18	25 5. 18	25 6. 18	25 7. 18	25 8. 18	25 9. 18
					29 C2 19	29 D. 19	29 1. 18	29 2. 18	29 3. 18	29 4. 18	29 5. 18	29 6. 18	29 7. 18	29 8. 18	29 9. 18
...1..	...2..	...3..	...4..②	...5..		20 D2 19	20 12 14	20 22 14	20 32 14	20 42 14	20 52 14	20 62 14	20 72 14	20 82 14	20 92 14
Working travel (inch)					Load (lbs)										
0	0	0	0	0	9.0	27	94	187	375	750	1498	2997	4497	5995	7493
3/8	1/4	1/2	3/4	1	12.0	33	106	211	423	845	1689	3377	5068	6756	8445
1/4	1/2	1	1 1/2	2	15.0	39	117	235	470	940	1879	3758	5639	7518	9396
3/8	3/4	1 1/2	2 1/4	3	18.0	45	129	259	518	1036	2069	4138	6210	8279	10348
1/2	1	2	3	4	20.9	51	141	282	565	1131	2259	4519	6781	9040	11299
5/8	1 1/4	2 1/2	3 3/4	5	23.9	57	153	306	613	1226	2450	4899	7352	9801	12251
3/4	1 1/2	3	4 1/2	6	26.9	62	165	330	661	1321	2640	5280	7923	10563	13203
7/8	1 3/4	3 1/2	5 1/4	7	29.9	68	177	354	708	1417	2830	5660	8494	11324	14154
1	2	4	6	8	32.9	74	189	378	756	1512	3020	6041	9065	12085	15106
1 1/8	2 1/4	4 1/2	6 3/4	9	35.9	80	201	401	804	1607	3211	6421	9636	12846	16057
1 1/4	2 1/2	5	7 1/2	10	38.8	86	213	425	851	1702	3401	6802	10207	13608	17009
1 3/8	2 3/4	5 1/2	8 1/4	11	41.8	92	225	449	899	1798	3591	7182	10778	14369	17960
1 1/2	3	6	9	12	44.8	98	236	473	946	1893	3782	7563	11349	15130	18912
1 5/8	3 1/4	6 1/2	9 3/4	13	47.8	104	248	497	994	1988	3972	7944	11920	15892	19863
1 3/4	3 1/2	7	10 1/2	14	50.8	110	260	520	1042	2083	4162	8324	12491	16653	20815
1 7/8	3 3/4	7 1/2	11 1/4	15	53.8	116	272	544	1089	2179	4352	8705	13062	17414	21766
1 31/32	3 15/16	7 7/8	11 13/16	15 3/4	56.0	120	281	562	1125	2250	4495	8990	13490	17985	22480
					Spring rate c (lbs/inch)										
											190	381	571	761	952
									63.5	127	254	507	761	1015	1269
						11.9	23.8	47.6	95.2	190	381	761	1142	1522	1903
					11.9	23.8	47.6	95.2	190	381	761	1522	2284	3045	3806
						47.6	95.2	190	381	761	1522	3045	4568	6090	7612

Pipe Support Design Process

Taking Advantage of Technology

Example of Caesar Output Spring Hanger Selection

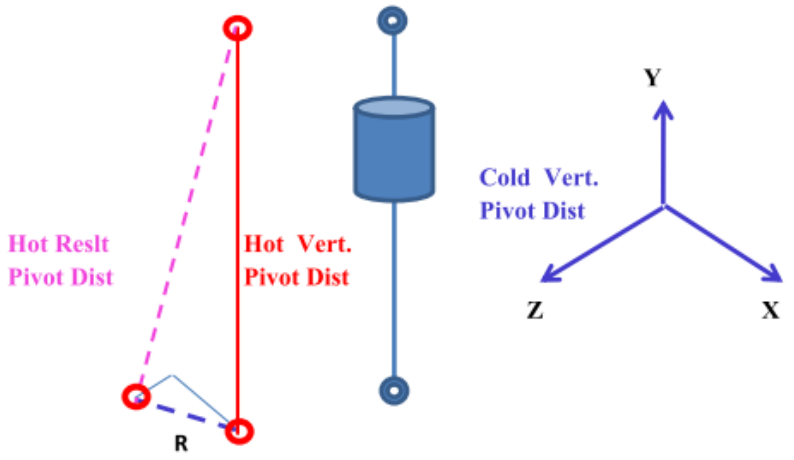
Computation of Angularity and Tri-Travel

```
      3485          Prog Design  VSH
            4(OPE)        0     -5383        0        0        0        0   -2.7455   -0.4422    0.4595
```

```
-------+---+-----+----+----------+--------+----------+---------+-------+--------
   3485   1       2162     -0.442     5383.      4710.          0.   1522.   2.784
          LISEGA                                          LOAD VARIATION =   13%
          ** VARIABLE SUPPORT SPRING DESIGNED ...................    MID RANGE
             MAXIMUM TABLE DISPLACEMENT RANGE ..... (in.)          7.800
             MINIMUM ALLOWED SINGLE SPRING LOAD ..... (lb.)     3000.000
             MAXIMUM ALLOWED SINGLE SPRING LOAD ..... (lb.)     9000.000
             RECOMMENDED INSTALLATION CLEARANCE ..... (in.)       14.040
-------+---+-----+----+----------+--------+----------+---------+-------+--------
```

DISPLACEMENTS

X =	-2.7455 in
Z =	0.4595 in
R = Caesar	2.7837 in
Y = Caesar	-0.4422 in
CVPD =	80.5000 in
Angularity	1.9805 deg
HVPD =	80.9422 in
HRPD =	80.9901 in
Tri Travel (HRPD-CVPD) =	-0.4901 in



LISEGA

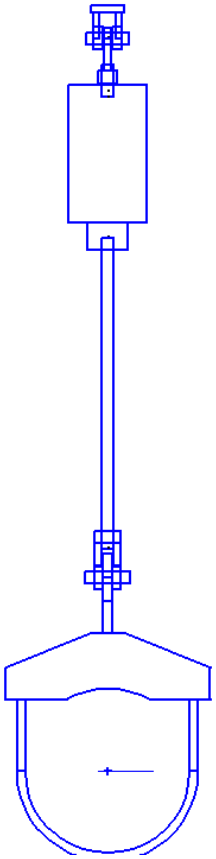
Data Required to Complete the Support Design

Load (Hot Load)	Caesar
Travel (Hot Displacements)	Caesar
Pipe Diameter/Insulation	Caesar
Design Temperature	Caesar
Support Configuration	Typical
Installation height	Model

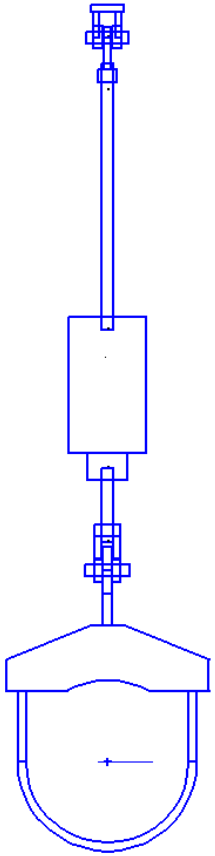
Pipe Support Design Process

Taking Advantage of Technology

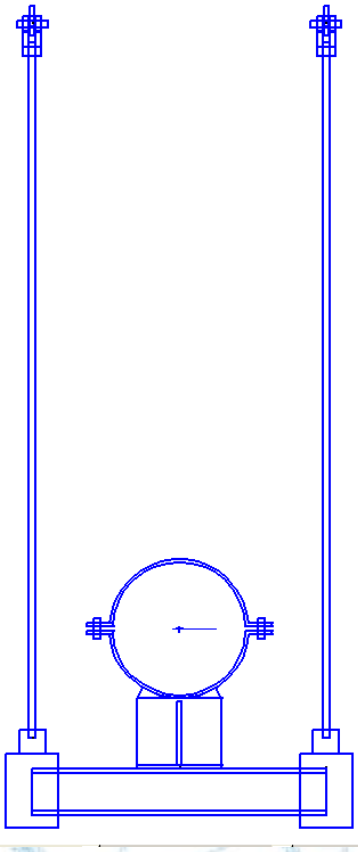
Spring Hanger Assembly Configuration Options



OPTION 01



OPTION 02

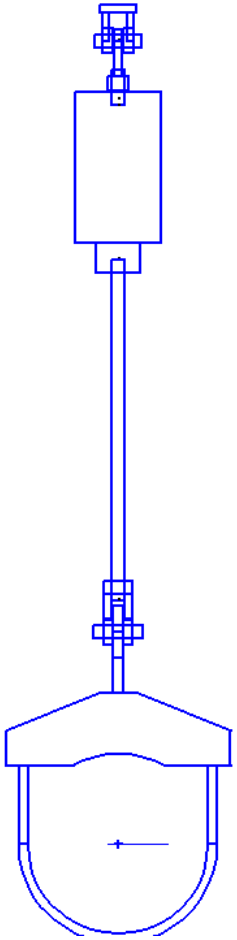


OPTION 03

Pipe Support Design Process

Taking Advantage of Technology

Manual Selection of Spring Hanger Assembly

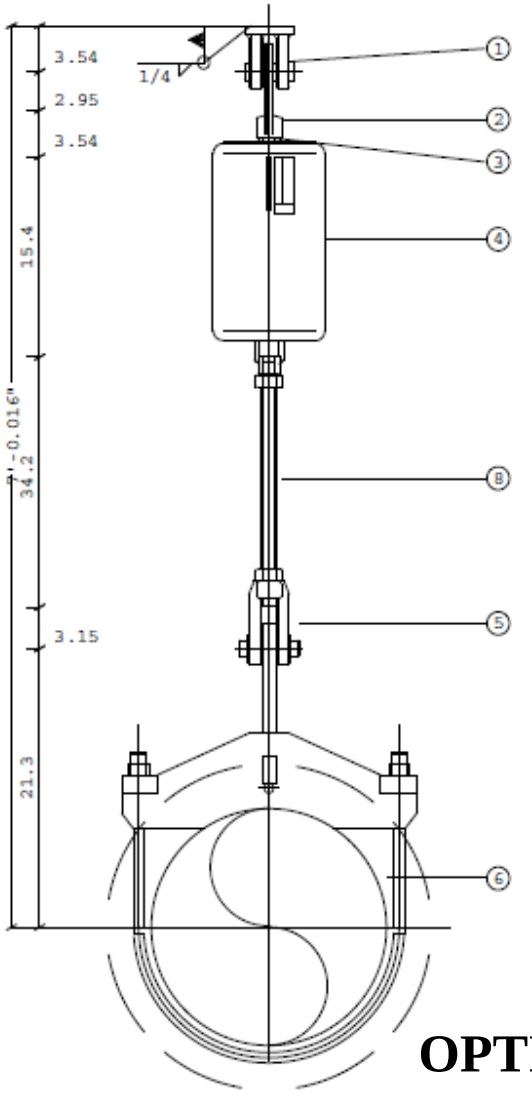


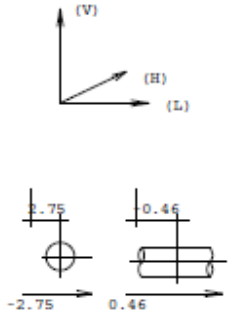
- Top Attachment
  - Selection based upon load, spring size and/or rod size
- Spring
  - Select spring based upon Hot Load and Movement from Stress Analysis + computation of tare weight
  - Calculate Cold load, Variability and Take-out Dimension
- Threaded Rod
  - Selection based upon load, spring size and/or rod size and HL
- Clamp Attachment
  - Selection based upon load, clamp size and/or rod size
- Clamp
  - Select type of clamp based upon load, temperature and pipe diameter

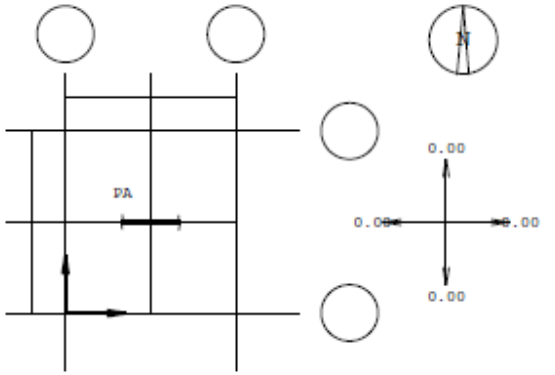
Pipe Support Design Process

Taking Advantage of Technology

Role of Tare Weight in the Selection of Springs







Prices shown are NET basepricee, excl. freight and packing.

Pos.	Description	Type	[inch]	Qty.	[lbs]	[]
8	Threaded rod	676323	(34.2)	1	10.36	23.60
7	Hexagonal nut	836918	1 1/4"	2	0.97	5.40
6	Pipe clamp	444623	D18.0	1	77.16	686.00
5	Clevis with pin	616922		1	5.95	51.10
4	Var. spring hanger	216228		1	88.18	462.00
3	Threaded stud	676123	3.5	1	0.93	2.70
2	Eye nut	606922		1	2.65	46.40
1	Weld-on clevis w.b.	736912		1	8.38	59.90
					194.58	1337.10

Node 3485

F(H) =	5383	lbs
F(C) =	4876	lbs
F(P) =	4876	lbs
F(Hy) =	0	lbs
late.=	-2.75	inch
horz.=	0.46	inch
vert.=	-0.44	inch
Ø OD =	18.00	inch
Insul=	3.50	inch
Temp.=	849	°F
Ø F =	11	%
Rate =	1522.2	#/in
Tot Tvl	3.94	inch
Preset	1.22	inch
Tri Tvl	-0.40	inch
Tvl res dn/up	2.32/1.22	inch

LISEGA

Customer :

Plant / System :

P.O. N° :

Addenda N° :

LISEGA Offer N° : 0-8-0 0

LICAD Dwg.- N° 13 -3-41193 Rev 0

Lisega, Inc.
Lisega
Drawing N° :

Prj. Mgr.: 2/14/2011

Checked :

C:\Documents and Settings\All Users\Documents\LISEGA\LICAD 9.0 - Projects

LICAD
©©
Vers. 9.1.0.0
Price List 01/08

OPTION 01

Pipe Support Design Process

Taking Advantage of Technology

Role of Tare Weight in the Selection of Springs

Caesar Output

NODE	NO. REQD	FIG. NO.	SIZE	VERTICAL MOVEMENT	HOT LOAD	THEORETICAL INSTALLED LOAD	ACTUAL INSTALLED LOAD	SPRING RATE	HORIZONTAL MOVEMENT
3485	1		2162	-0.442	5383.	4710.	0.	1522.	2.784
	LISEGA						LOAD VARIATION =		13%

** VARIABLE SUPPORT SPRING DESIGNED ..... MID RANGE
MAXIMUM TABLE DISPLACEMENT RANGE ..... (in.) 7.800
MINIMUM ALLOWED SINGLE SPRING LOAD ..... (lb.) 3000.000
MAXIMUM ALLOWED SINGLE SPRING LOAD ..... (lb.) 9000.000
RECOMMENDED INSTALLATION CLEARANCE ..... (in.) 14.040

6	Pipe clamp	444623	D10.0	1	77.16	16Mo3
5	Clevis with pin	616022		1	5.95	Carbon St
4	Var. spring hanger	216220		1	88.10	

LICAD Output

Node 3485

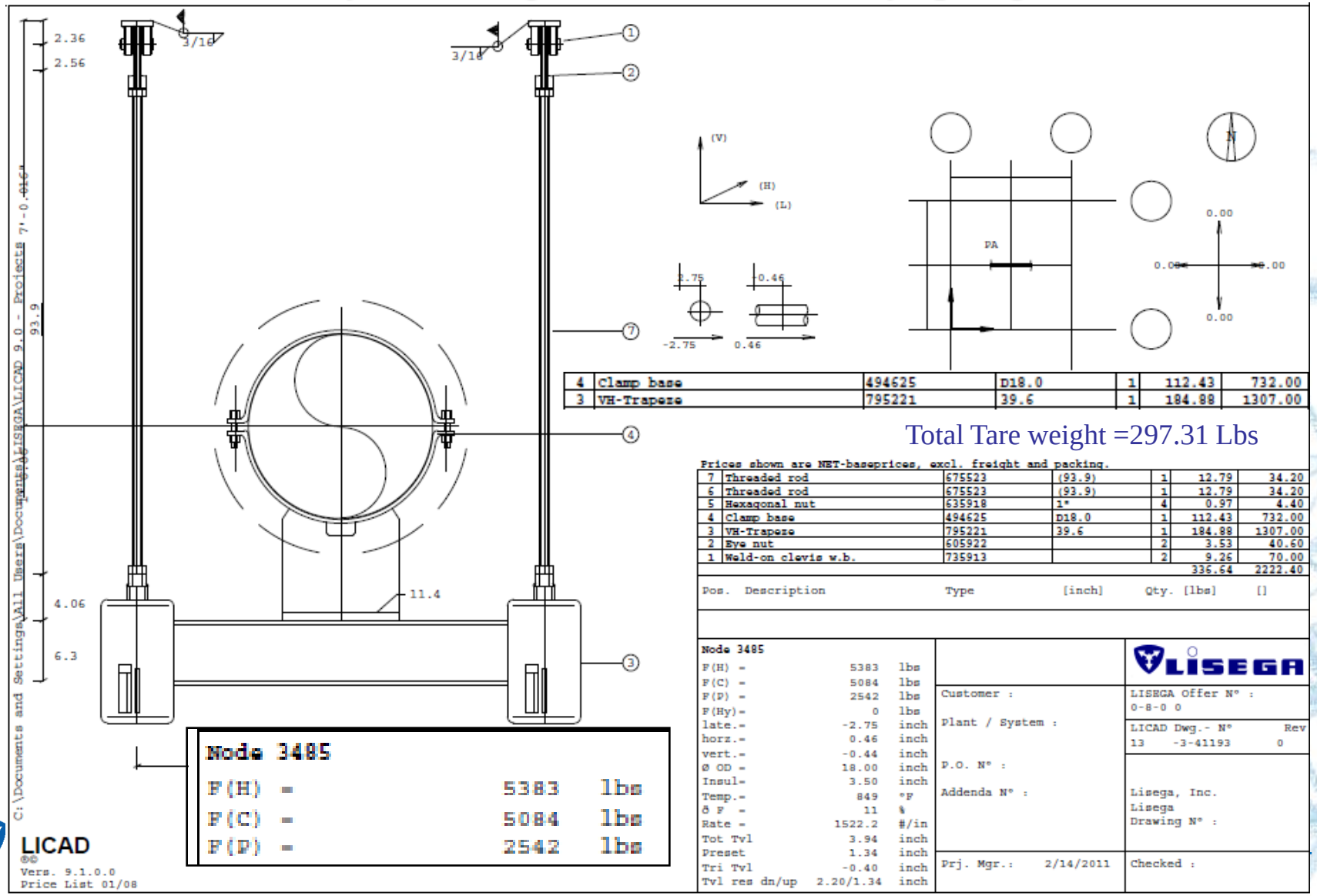
F(H) =	5383	lbs
F(C) =	4876	lbs
F(P) =	4876	lbs
F(Hy) =	0	lbs
late. =	-2.75	inch
horz. =	0.46	inch
vert. =	-0.44	inch
Ø OD =	18.00	inch
Insul =	3.50	inch
Temp. =	849	°F
δ F =	11	%
Rate =	1522.2	#/in
Tot Tvl	3.94	inch
Preset	1.22	inch
Tri Tvl	-0.40	inch
Tvl res dn/up	2.32/1.22	inch

OPTION 01

Pipe Support Design Process

Taking Advantage of Technology

Role of Tare Weight in the Selection of Springs



4	Clamp base	494625	D18.0	1	112.43	732.00
3	VH-Trapeze	795221	39.6	1	184.88	1307.00

Total Tare weight =297.31 Lbs

Prices shown are NET-baseprices, excl. freight and packing.

7	Threaded rod	675523	(93.9)	1	12.79	34.20
6	Threaded rod	675523	(93.9)	1	12.79	34.20
5	Hexagonal nut	635918	1"	4	0.97	4.40
4	Clamp base	494625	D18.0	1	112.43	732.00
3	VH-Trapeze	795221	39.6	1	184.88	1307.00
2	Eye nut	605922		2	3.53	40.60
1	Weld-on clevis w.b.	735913		2	9.26	70.00
					336.64	2222.40

Pos.	Description	Type	[inch]	Qty.	[lbs]	[]

Node 3485

F(H) =	5383	lbs
F(C) =	5084	lbs
F(P) =	2542	lbs

F(H) =	5383	lbs
F(C) =	5084	lbs
F(P) =	2542	lbs
F(Hy) =	0	lbs
late. =	-2.75	inch
horz. =	0.46	inch
vert. =	-0.44	inch
ø OD =	18.00	inch
Insul =	3.50	inch
Temp. =	849	°F
δ F =	11	%
Rate =	1522.2	#/in
Tot Tvl	3.94	inch
Preset	1.34	inch
Tri Tvl	-0.40	inch
Tvl res dn/up	2.20/1.34	inch

LISEGA

Customer :

Plant / System :

P.O. N° :

Addenda N° :

Prj. Mgr.: 2/14/2011

LISEGA Offer N° : 0-8-0 0

LICAD Dwg.- N° 13 -3-41193 Rev 0

Lisega, Inc.
Lisega
Drawing N° :

Checked :

Pipe Support Design Process

Taking Advantage of Technology

Solution for the Design of a Support Hanger Assembly

- Manual Selection of proper hanger components and arranging them together to meet the design and dimensional requirements of space available

  Time consuming task which can eat up mega project budget hours

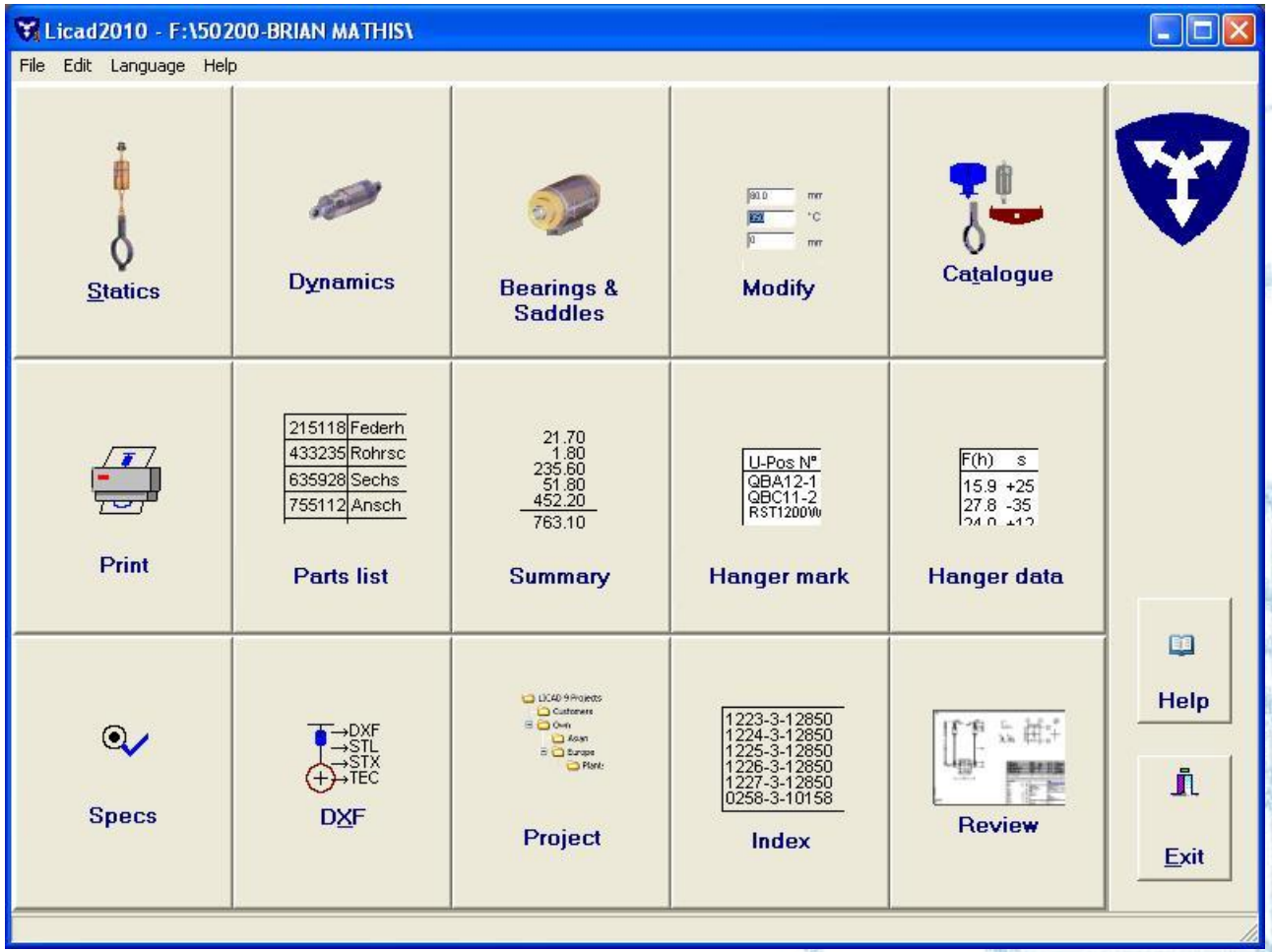
- Lisega software LICAD allows the designer to utilize design data from Caesar and typical support configuration details to generate pipe support drawings within a few minutes

  Huge savings in costs and project budget hours

Pipe Support Design Process

Taking Advantage of Technology

LICAD – A State of Art Pipe Support Design Tool



Pipe Support Design Process

Taking Advantage of Technology

LICAD – A State of Art Pipe Support Design Tool

- LICAD has been a design tool since 1989 and has achieved industry recognition for its robust design and interface capabilities
  - Material selections based upon load and temperature
  - Over Sixty Support Assembly Configurations can be designed and drawings produced
  - Able to export support information into 3rd party 2D & 3D programs including placing the hanger in the proper location in the 3D model
  - Allows any combination of metric and UNC inputs as well as outputs
  - Print option allows multiple (output) languages

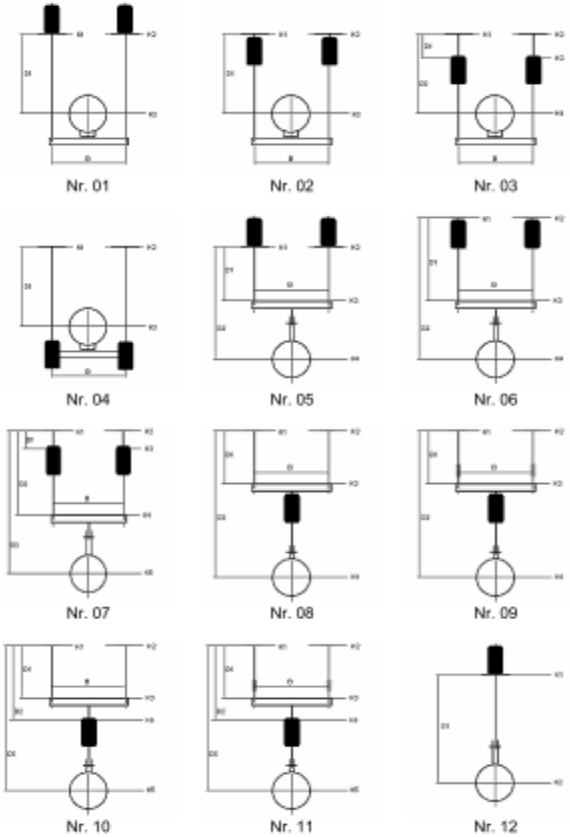
Pipe Support Design Process

Taking Advantage of Technology

LICAD – Built-in Standard Support Configurations

7.2 The supports configurations (symbols)

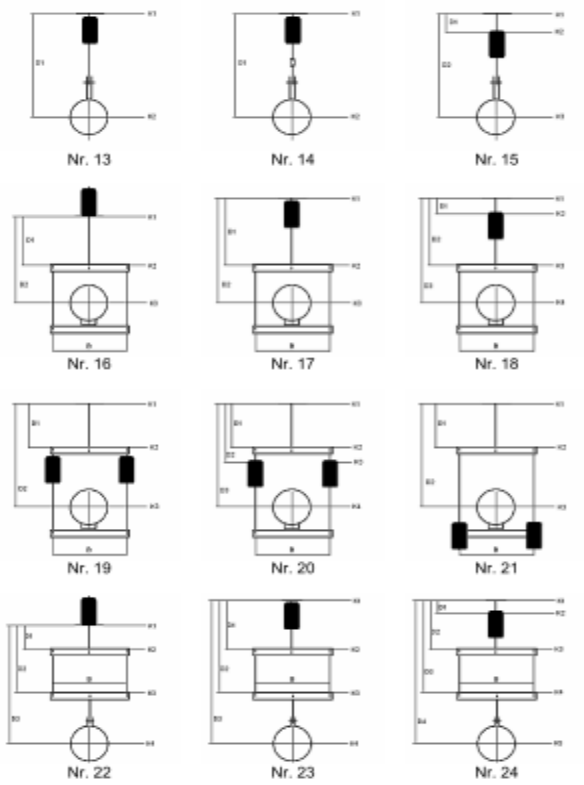
7.2.1 Configurations in the static field



Pipe Support Design Process

Taking Advantage of Technology

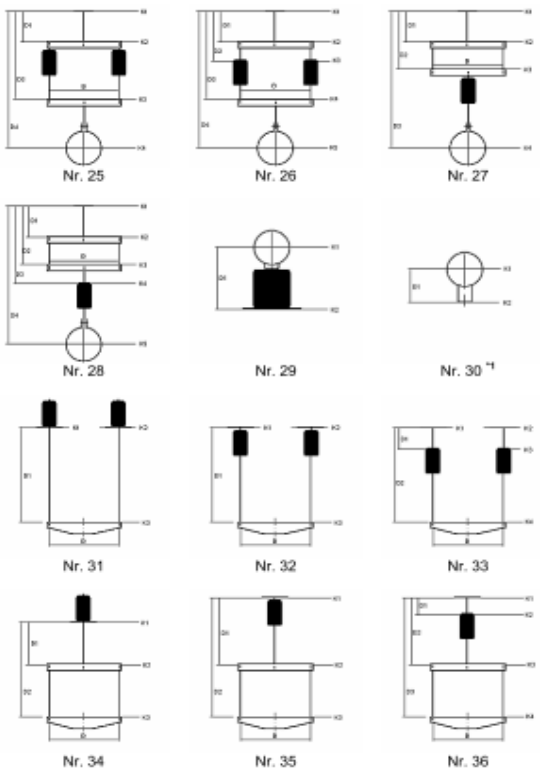
LICAD – Built-in Standard Support Configurations



Pipe Support Design Process

Taking Advantage of Technology

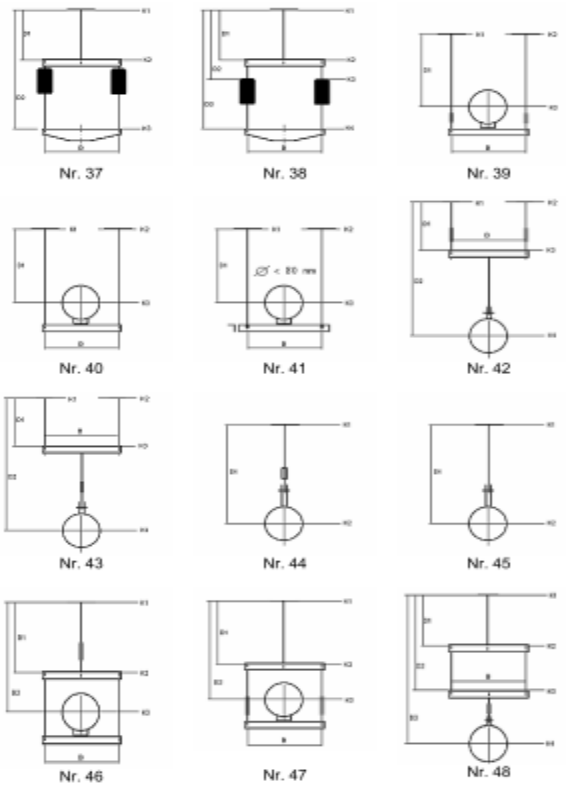
LICAD – Built-in Standard Support Configurations



Pipe Support Design Process

Taking Advantage of Technology

LICAD – Built-in Standard Support Configurations



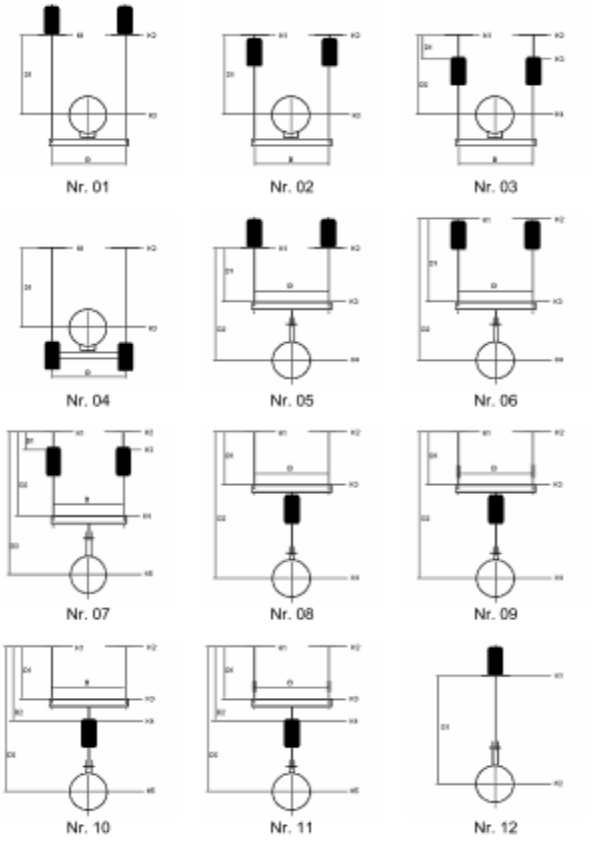
Pipe Support Design Process

Taking Advantage of Technology

LICAD – Built-in Standard Support Configurations

7.2 The supports configurations (symbols)

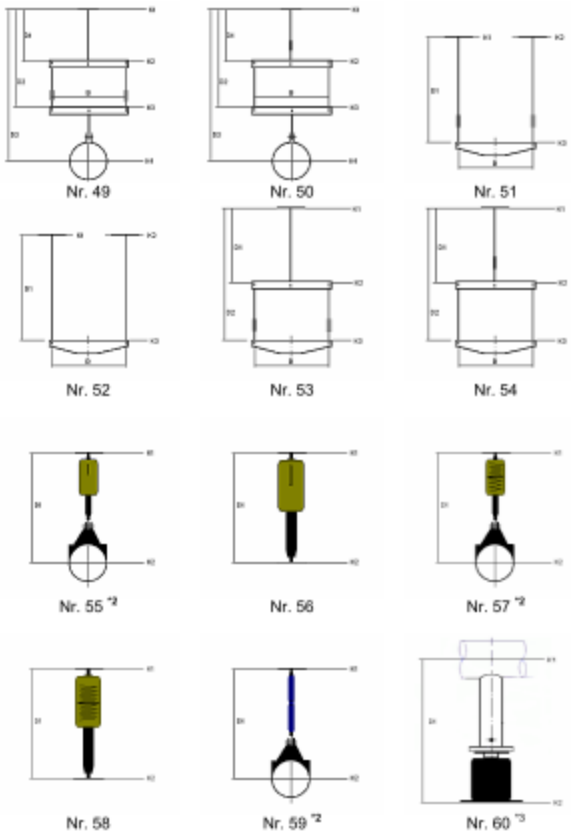
7.2.1 Configurations in the static field



Pipe Support Design Process

Taking Advantage of Technology

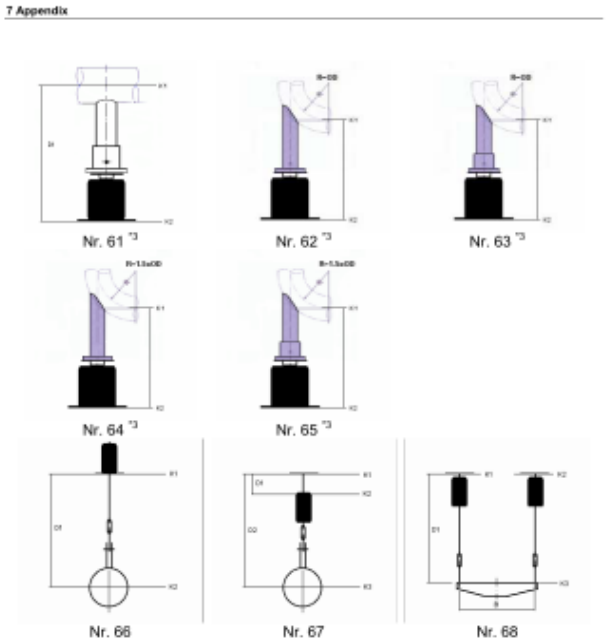
LICAD – Built-in Standard Support Configurations

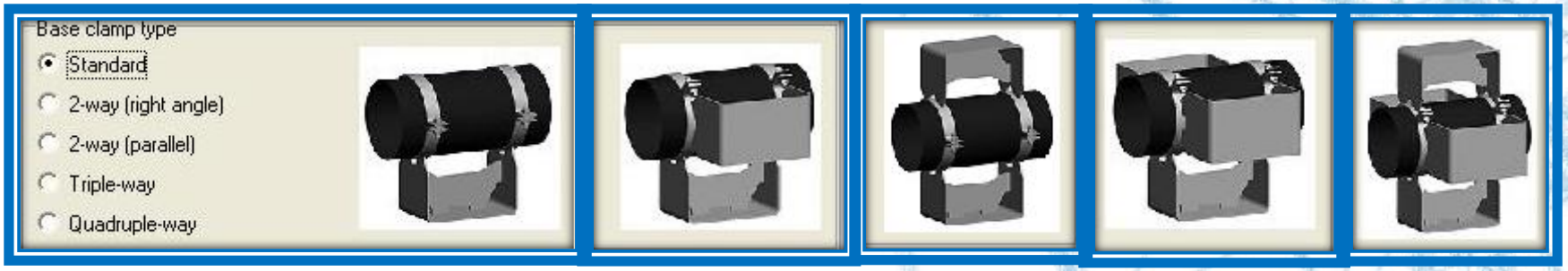


Pipe Support Design Process

Taking Advantage of Technology

LICAD – Built-in Standard Support Configurations





Pipe Support Design Process

Taking Advantage of Technology

LICAD – A State of the Art Pipe Support Design Tool

- LICAD program has the ability to build a project specific support design/drafting specification
- Dual capability of designing supports on an individual basis or through import of Excel data sheet(s) containing support design data
- Can compile a summary of all the parts and quantities including total weight for all the support drawings residing in a project system folder (HRH, CRH etc)
- Can compile a summary of total price for all the supports drawings residing in a project system folder based on Lisega unit price list

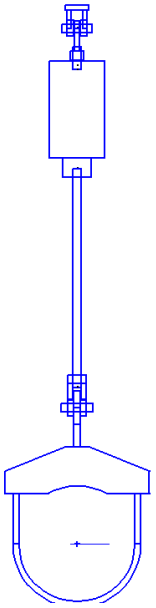
Pipe Support Design Process

Taking Advantage of Technology

LICAD – Demonstration

Spring Hanger Design

- Support Data
  - Load (Hot Load) 5383 lbs
  - Travel (Hot Displ.) Lat. -2.75”, Axial 0.46”, Ver. -0.44”
  - Pipe Diameter/Insulation 18”/3.5”
  - Design Temperature 849 deg F
  - Support Configuration Option 3
  - Installation height 7 ft
  - Distance between Cans 39.61”
  - Can Pre-welded to beam



LISEGA

LICAD Excel Interface

- Saves time from manual inputting of hanger design information
- Creates hangers from import of hanger data from Excel sheet
- Eliminates manual (design) entry errors
- Unlimited quantity of hangers (1 to …..)

Pipe Support Design Process

Taking Advantage of Technology

LICAD – Demonstration

LICAD Excel Interface

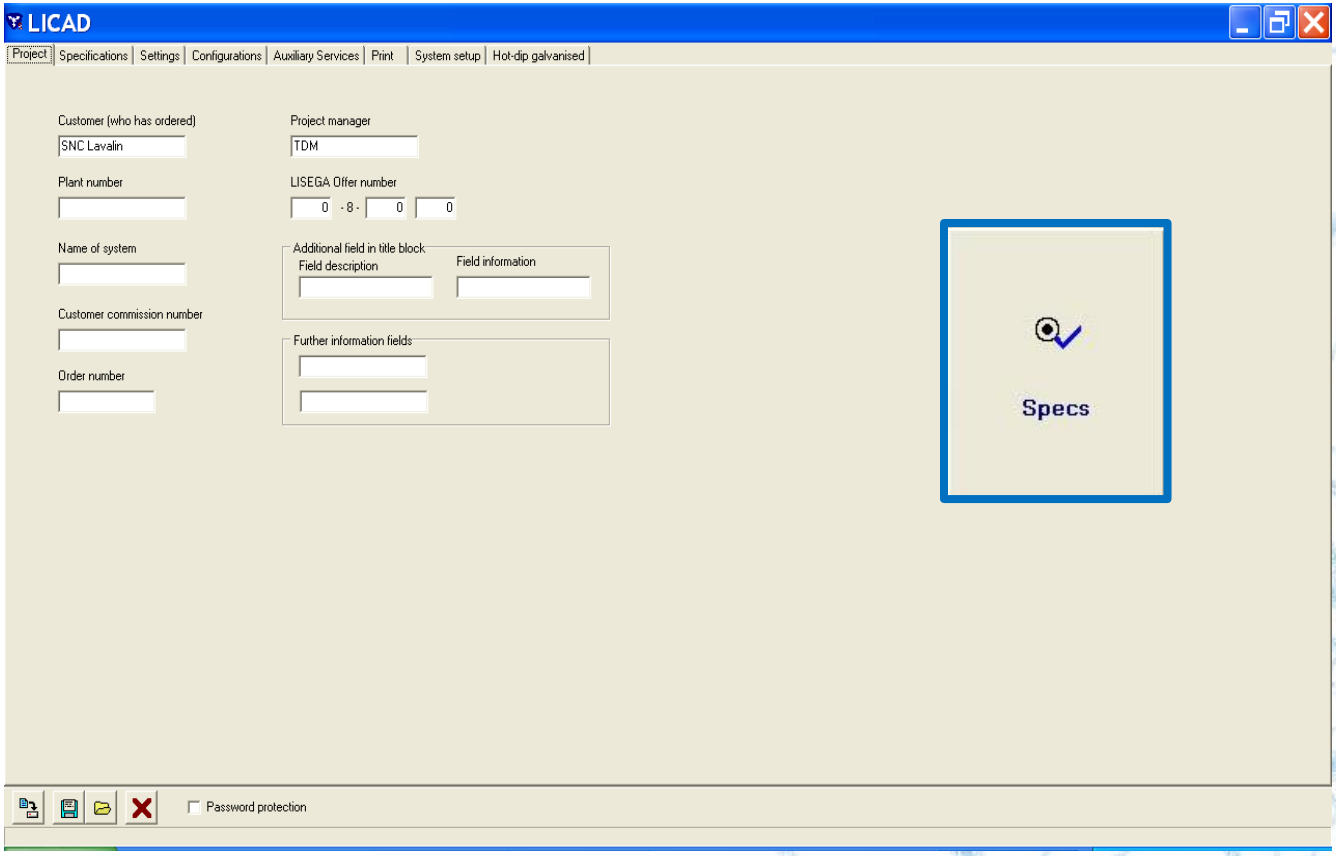
Hanger mark	Config. No	DIM 1	Hydro Load	Insul	Load	Move Z	Move X	Move Y	Pipe	Temp	Top Con	X_Coor	Y_Coor	Z_Coor
B1V	13	7'-0"	0	3.5	5383	-0.44	0.46	-2.75	18	849	73	0	0	0
B1V2	13	4'-0"	0	2	2525	-0.5	0.33	-1	14	650	73	0	0	0
B1V3	13	3'-0"	0	1	1300	-0.75	0.25	0.38	4.5	500	73	0	0	0
B1V4	13	4'-6"	100	1.5	1600	-0.56	0.25	0.5	6.625	450	75	0	0	0
B1V5	13	5'-0"	300	2	1900	-0.75	0.5	1	8.625	950	73	0	0	0

Pipe Support Design Process

Taking Advantage of Technology

LICAD – Demonstration

Creating Project Specific Specification

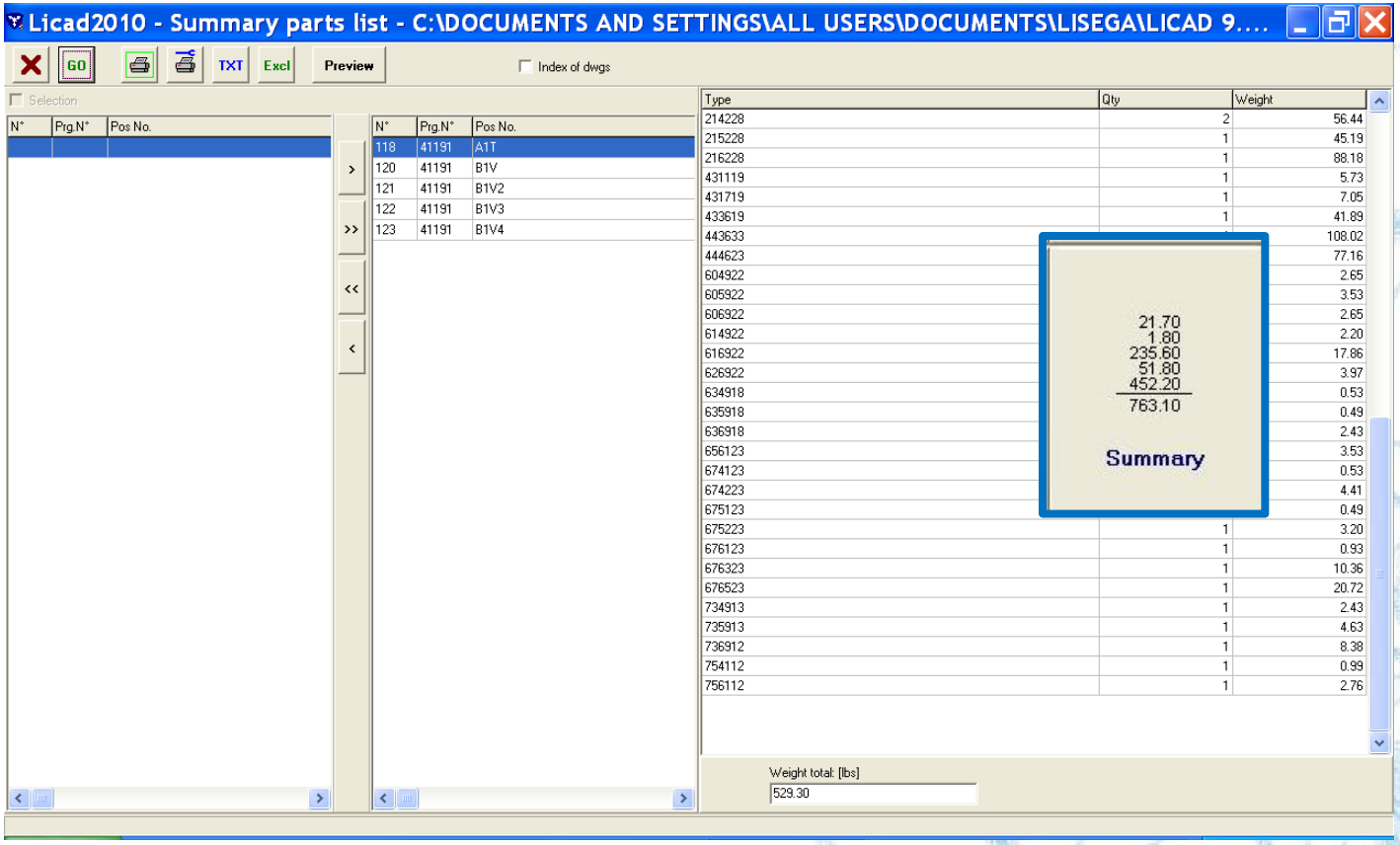


Pipe Support Design Process

Taking Advantage of Technology

LICAD – Demonstration

Summary of All Parts and Quantities

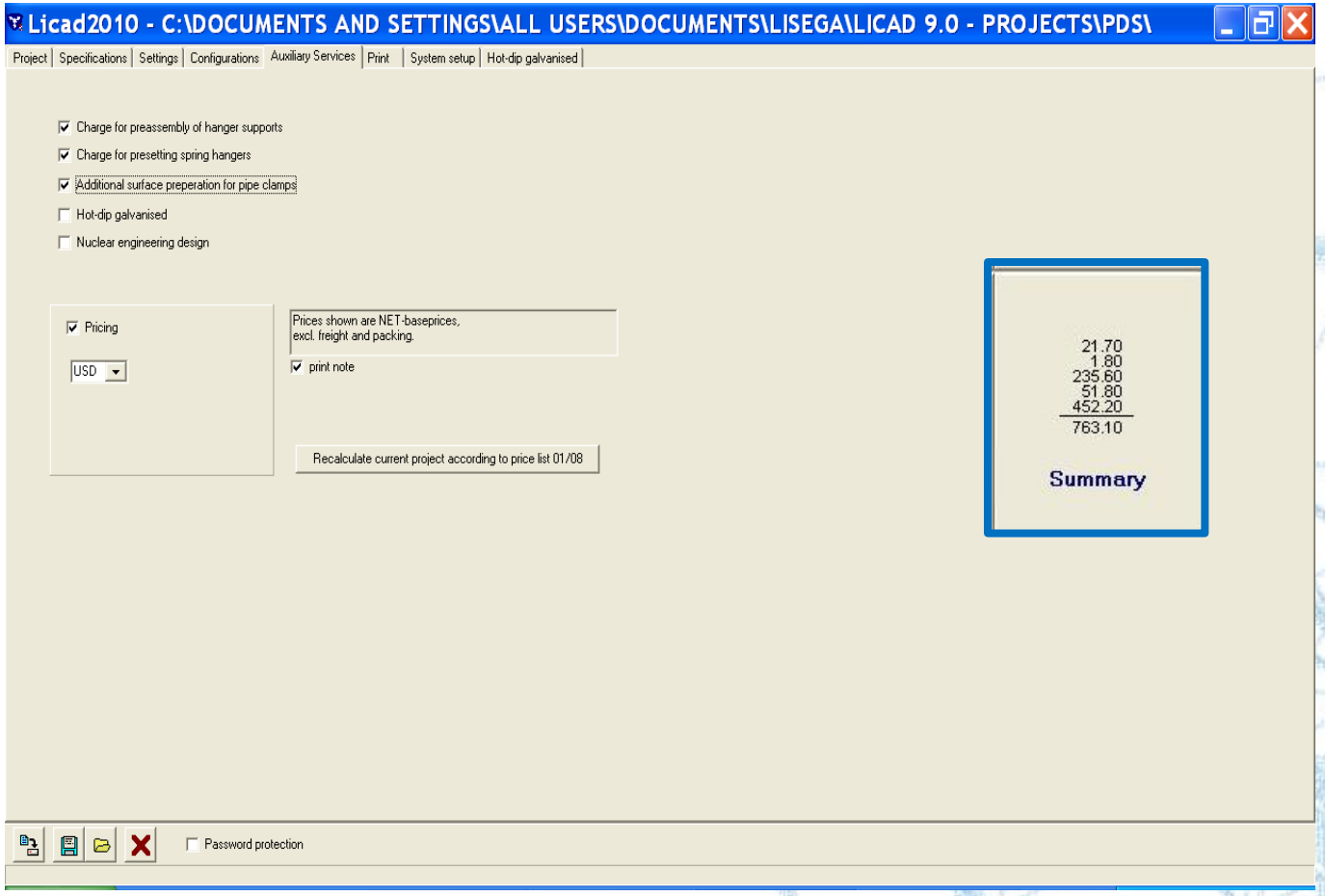


Pipe Support Design Process

Taking Advantage of Technology

LICAD – Demonstration

Summary of Pricing per List Price -- Creating Project Budgets



Export LICAD information to 3rd Party 2D & 3D Programs

Pipe Support Design Process

Taking Advantage of Technology

Export LICAD information to 3rd Party 2D & 3D Programs

AutoCAD

V8i MicroStation

PELICAN FORGE SOFTWARE CORPORATION

INTERGRAPH

SmartPlant® Enterprise

Bentley

Bentley PlantSpace Piping

AVEVA CONTINUAL PROGRESSION

AVEVA PDMS 12.0

NAVIS WORKS

CADCENTRE

LISEGA

LICAD Interfaces

2D application

Via a DXF export file, the design gets transferred with bills of material, location plans and letter heads as an option, to various CAD programs, e.g. AutoCAD or MicroStation.

3D application

LICAD using defined interfaces

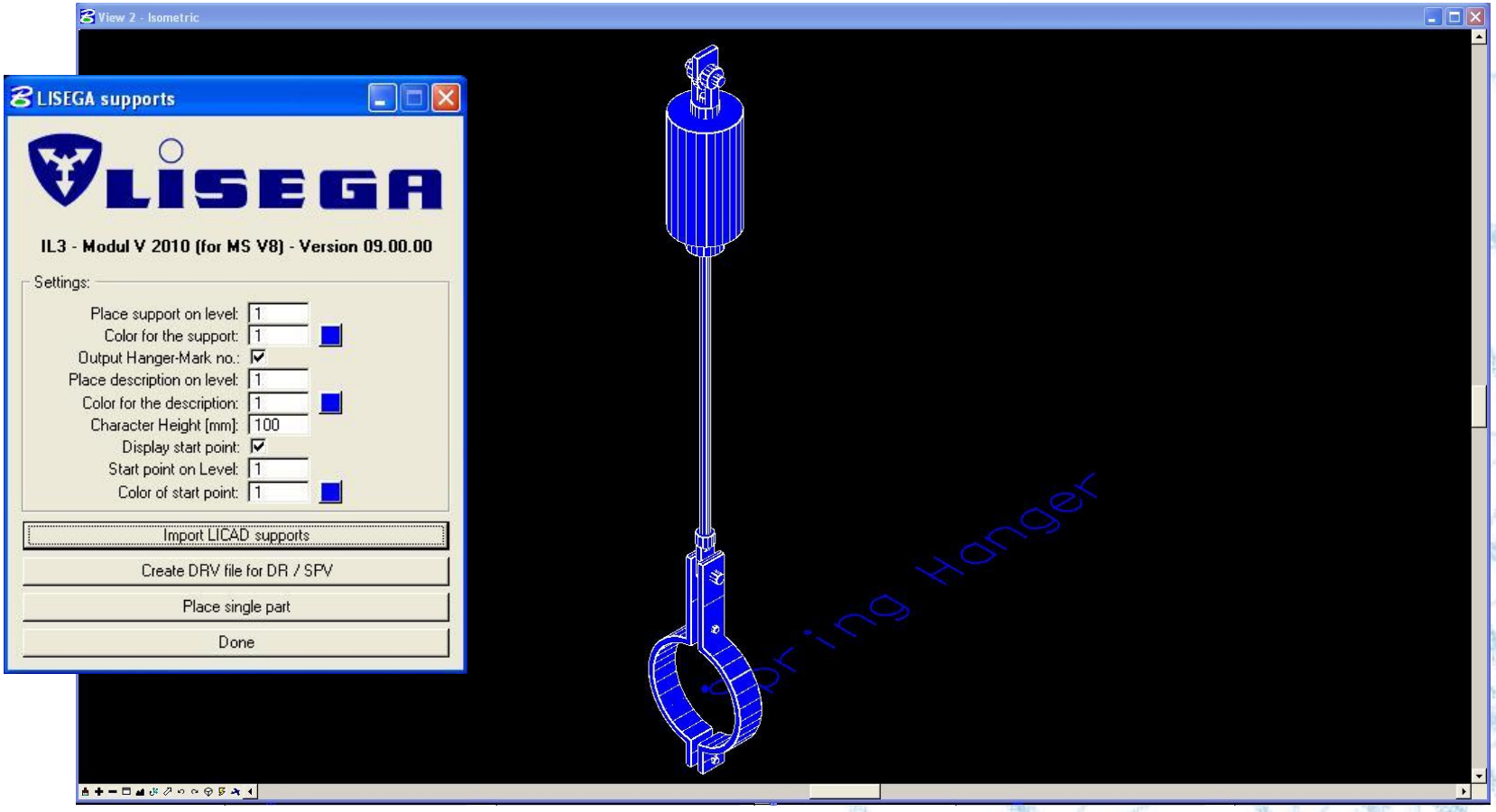
LICAD generated designs are transferred to 3D applications which are true to scale

- INTERGRAPH – SmartPlant and PDS
- AVEVA -- PDMS, CADCENTRE
- BENTLEY -- PlantSpace Support Modeler
- NAVISWORKS, LightWork Design

Pipe Support Design Process

Taking Advantage of Technology

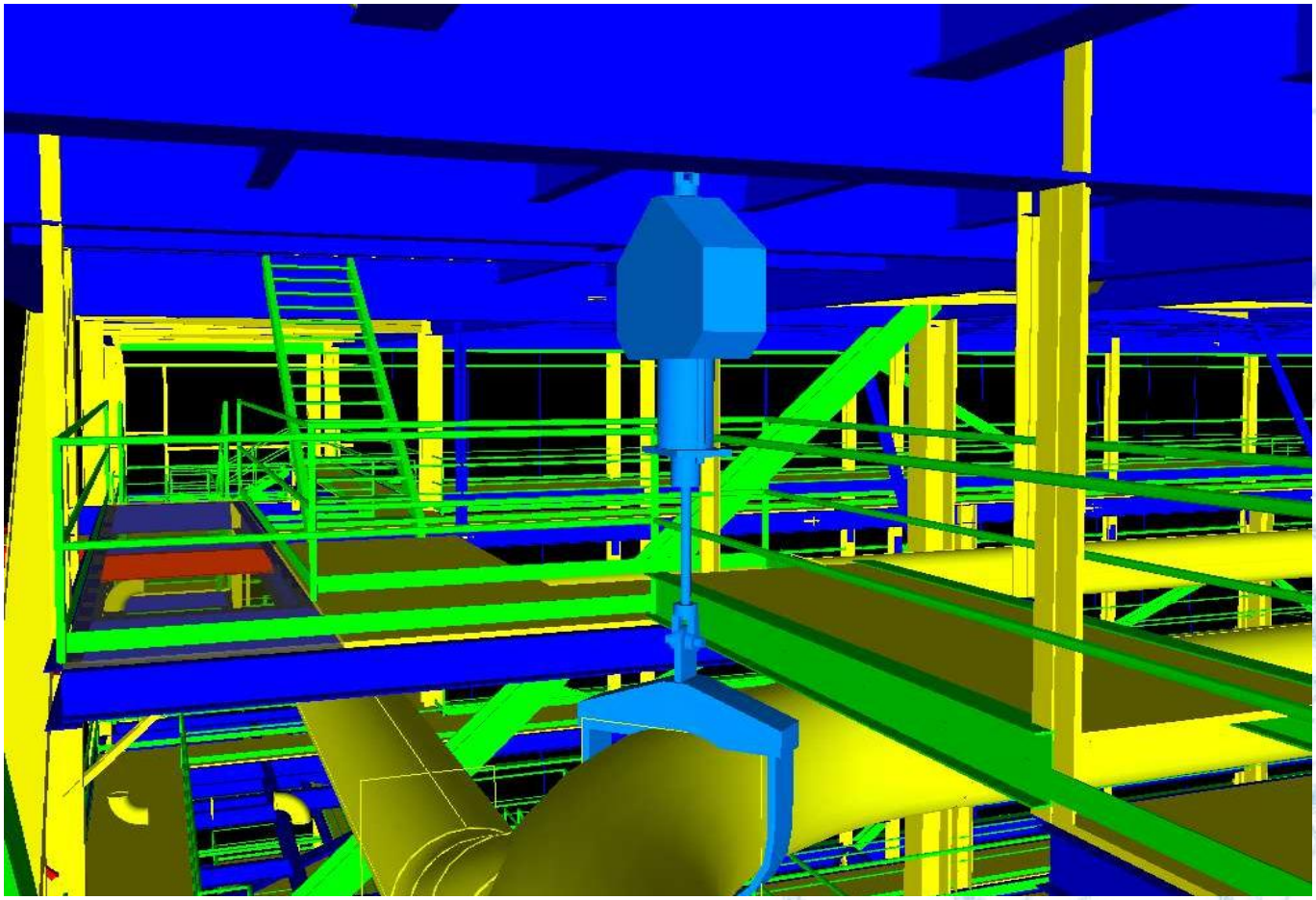
Demonstration - Exporting LICAD in 3D Models



Pipe Support Design Process

Taking Advantage of Technology

Demonstration - Exporting LICAD in 3D Models



Pipe Support Design Process

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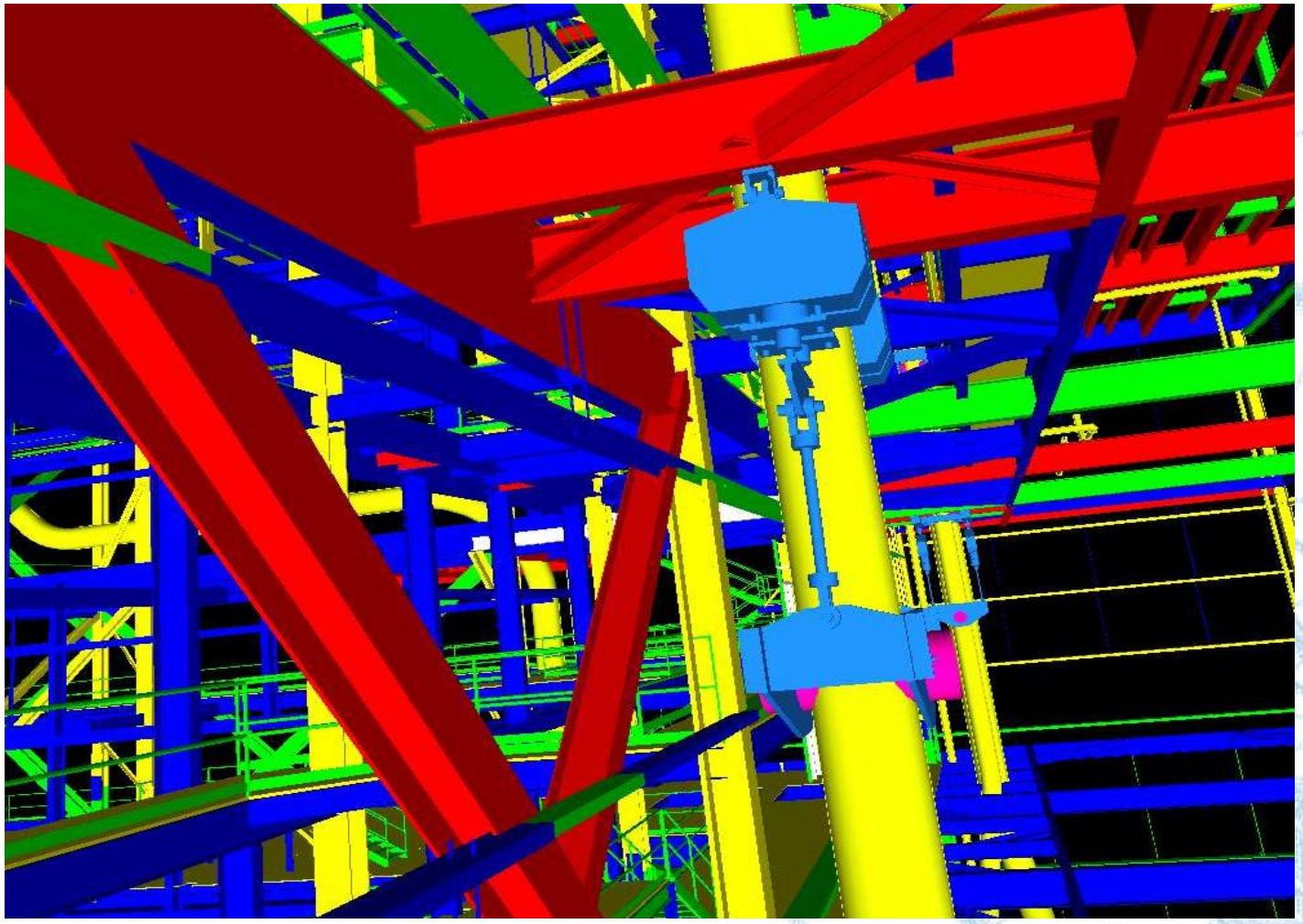
Demonstration - Exporting LICAD in 3D Models



LICAD Information

The LICAD program, along with any interfaces, can be downloaded from the LISEGA website

Free of Charge

at www.lisega.com download section

Technical assistance: James Hill (865) 940-5200 ext. 325
e-mail: james.hill@us.lisega.com

Reference Information: The LICAD Quick set-up guide

Pipe Support Design Process

Taking Advantage of Technology

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Question & Answer Session

LISEGA

performance with system