SENIOR FLEXONICS INC.
PATHWAY DIV. REF: Z15077
CUSTOMER REF: MDSP-1301/6301
DATE: 04/02/08 10:58
AUTHOR: Dru Moore

ITEM: 1

SENIOR FLEXONICS INC.
PATHWAY DIVISION
SHEET 2 OF 2
REVISION 2/27/2008
APPROVED BY:

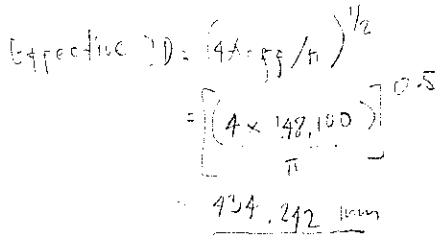
DESIGN IN ACCORDANCE WITH ASME B31.3, 2006 EDITION, APPENDIX X, AND THE STANDARDS OF THE EXPANSION JOINT MANUFACTURER'S ASSOCIATION, INC. 8TH. EDITION.

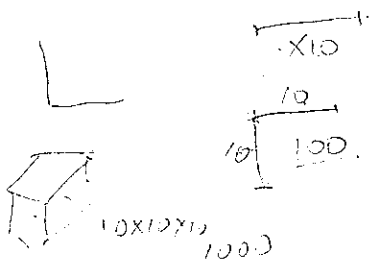
UNIVERSAL BELLOWS DESIGN ANALYSIS
PLY TESTABLE BELLOWS DESIGN

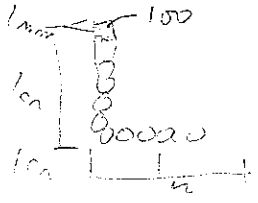
DESIGN PRESSURE	3.4 BARg	345 KPa
DESIGN TEMPERATURE		300 DEG. C.
BELLOWS MATERIAL		B443 Alloy 625 Gr. 1 (NO6625)
ALLOWABLE STRESS		241,545 KPa
ELASTIC MODULUS		192,303,448 KPa
WELD JOINT EFFICIENCY		100%

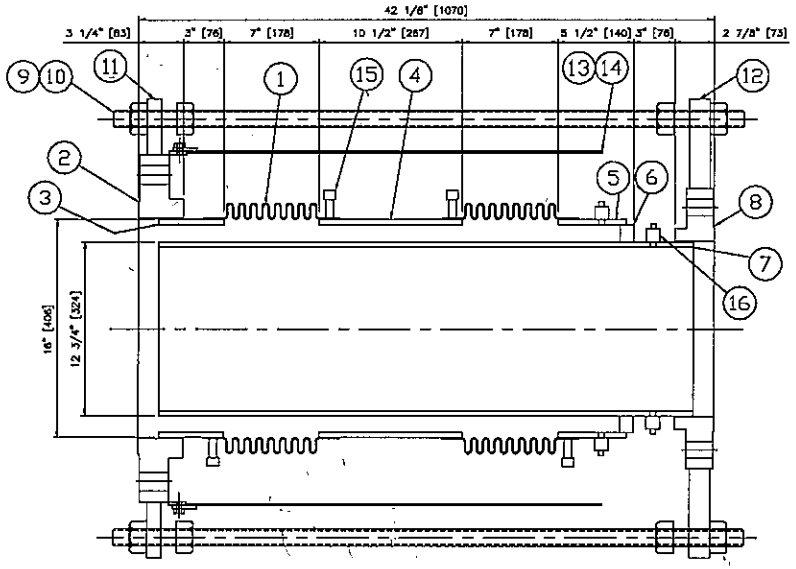
		DESIGN MOVEMENT CONDITIONS (mm, Deg)						KPa	KPa	KPa
CONDITION	CYCLES	AXIAL 1	AXIAL 2	LAT 1	LAT 2	ANG 1	ANG 2	PRESSURE	S5	S6
A	1000	38.100	0.000	35.128	.0.000	0.00	0.00	345	15771	1443465

INSIDE DIAMETER		406.4 mm
OUTSIDE DIAMETER		462.0 mm
NUMBER OF CONVOLUTIONS		8 X 8 CONVOLUTIONS
MATERIAL THICKNESS		0.940 mm
NUMBER OF PLIES		2 PLIES
FREE LENGTH OVER CONVOLUTIONS		177.8 mm
INSTALLED LENGTH OVER CONVOLUTIONS		177.8 mm
TANGENT LENGTH		38.100 mm
UNIVERSAL LIVE LENGTH		622.3 mm
S1 (TANGENT CIRC. MEMBRANE STRESS DUE TO PRESSURE)		37,451 KPa
S2 (CIRC. MEMBRANE STRESS DUE TO PRESSURE)		14,187 KPa
S3 (MERIDIONAL MEMBRANE STRESS DUE TO PRESSURE)		2,455.8 KPa
S4 (MERIDIONAL BENDING STRESS DUE TO PRESSURE)		48,344.4 KPa
S3+S4		50,800.1 KPa
S5 (MERIDIONAL MEMBRANE STRESS DUE TO DEFLECTION)		SEE TABLE ABOVE KPa
S6 (MERIDIONAL BENDING STRESS DUE TO DEFLECTION)		SEE TABLE ABOVE KPa
ST (STRESS RANGE FOR PRIMARY DESIGN CONDITION)		1,494,796 KPa
DESIGN CYCLE LIFE FOR PRIMARY DESIGN CONDITION		1,000 CYCLES
RATED CYCLE LIFE FOR PRIMARY DESIGN CONDITION		1,314 CYCLES
MAXIMUM DESIGN PRESSURE BASED ON STABILITY	14.6 BARg	1461 KPa
AXIAL SPRING RATE		287 N/mm
LATERAL SPRING RATE		130 N/mm
ANGULAR SPRING RATE		118 N-M/Deg.
TORSIONAL SPRING RATE		1.239E+05 N-M/Deg.
BELLOWS EFFECTIVE AREA		1481 Cm^2









TYPICAL SECTION

FLOW

NOTES:

1 – THIS EXPANSION JOINT ASSEMBLY HAS BEEN DESIGNED AND WILL BE FABRICATED IN ACCORDANCE WITH THE EJMA STANDARDS 8TH EDITION AND ASME B31.3.

2 – SEE TECHNICAL COMMENTARY FOR ADDITIONAL NOTES, EXCEPTIONS & CLARIFICATIONS.

NOTE	REV	PIECE	DESCRIPTION	DET/SH	QTY	MATERIAL
		16	COUPLING ~ 1/4" NOM. 3000# HALF COUPLING W/ PLUG		4	C.S.
		15	TEST PORT ~ 1/4" NOM. SCH.80S PIPE X 2" LG W/NPT CAP		4	S.S.
		14	COVER CLIPS ~ STANDARD GCCF-375		10	S.S.
		13	COVER ~ 11 GA. (0.118" THK.) X 26" OD X 30 1/2" LG.		1	C.S.
		12	LUG ~ 1 1/2" THK. X 3.5" WIDE X 6 5/8" HIGH		4	A516-70
		11	LUG ~ 1" THK. X 4" SQUARE		4	A516-70
		10	NUT ~ 1 1/4" NOM. DIAM. HEAVY HEX		16	A194-2H
		9	LIMIT ROD ~ 1 1/4" NOM DIAM. FULLY THREADED X 46 1/4" LG.		4	A193-B7
		8	FLANGE ~ 12" NOM. DIAM. 300# RFSO (B16.5)		1	A105N
		7	PIPE/LINER ~ 12" NOM. DIAM. STD.WT. (0.375" WALL) X 39" LG.		1	A106B
		6	RING ~ 1" THK. X 12 7/8" ID X 15 3/16" OD		1	A516-70
		5	PIPE ~ 16" NOM. STD.WT. (0.375" WALL) X 5" LG.		1	A106B
		4	PIPE ~ 16" NOM. STD.WT. (0.375" WALL) X 10 1/2" LG.		1	A106B
		3	PIPE ~ 16" NOM. STD.WT. (0.375" WALL) X 4 3/4" LG.		1	A106B
		2	FLANGE ~ 16" NOM. DIAM. 300# RFSO (B16.5)		1	A105N
		1	BELLOWS ~ 2-PLY TESTABLE 8 + 8 CONVOLUTIONS		2	B443-625

MEDIA	DESIGN TEMPERATURE	DRAWN BY	DATE	CHECKED BY	DATE	ENG APPROVAL	DATE	QA APPROVAL	DATE	EST. REVIEWED	DATE
GENERAL PROCESS	572°F [300°C]	DM	4/3/08								

DESIGN PRESSURE	PRESSURE THRUST
50 PSIG [345 KPA]	

TYPE OF CYCLE	MOVEMENT CYCLES CONCURRENT	MOVEMENT CYCLES NON-CONC.	MOVEMENTS AXIAL (IN) COMP	AXIAL (IN) EXTENSION	LATERAL (IN)	ANGULAR (DEG)
DES	1000	N/A	1.5"	–	1.383"	–
			[38]		[35]	

* – SEE BELLOWS DESIGN ANALYSIS

AXIAL SPRING RATE	LATERAL SPRING RATE	ANGULAR SPRING RATE
* LBS/IN	* LBS/IN	* IN-LBS/DEG

MANUFACTURING TOLERANCES (UNLESS OTHERWISE SHOWN)

LINEAR	ANGULAR	OUT OF ROUNDNESS – DIFFERENCE BETWEEN MAJOR & MINOR DIA	DIAMETER
±1/8" THRU 12", ±3/16" OVER 12"	± 2°	1% MAX	± .5%

TOLERANCES FOR STANDARD DETAIL COMPONENTS PER PRODUCT STANDARDS OR TRAVELERS

ASSEMBLY WEIGHT (APPROX.) SEE QUOTE LBS

Senior Operations, Inc.
Senior Flexonics Pathway
Myej.com

16"/12" NOMINAL DIAMETER EXPANSION JOINT

CUSTOMER	QTY
MITSUI ENGINEERING & SHIPBUILDING	2
INQUIRY NUMBER	CUSTOMER ITEM NO.
036PR5101	1
EJ TAG NUMBER	DRAWING SCALE
MDSP-1301/6301	N.T.S.
CODE IDENT NO. 23150 / DRAWING NUMBER B-01-Z15077	REV. – / SHEET 1 OF 1