



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
796 ROOSEVELT ROAD
GLEN ELLEN, ILLINOIS 60127

November 19, 1981

C. F. Braun & Company
ATTN: Mr. Wayne L. Stiebe
Assistant Vice-President
1000 South Fremont Avenue
Alhambra, California 91802

Gentlemen:

Please find attached additional data we obtained as part of our material sampling program at LaSalle County Nuclear Station which is an addition to the data provided to you on October 7, 1981.

If you have any questions on the above, please contact Nick Jackiw or Roger Lankbury of my staff at (312) 932-2500.

Sincerely,

C. E. Sorelius

C. E. Sorelius, Director
Division of Engineering
and Technical Programs

Attachments: As Stated

cc: T. Novak, NRR
A. Bournia, NRR
L. Speseard

NRC REGION III

QUESTIONS ON HVAC SYSTEMS

Question 1: The NRC tested 4 bolts which were 3/8 inch A307 Grade A. The ASTM hardness requirement is between 121 and 241 Brinell. One of the 4 bolts tested had a hardness of 287 Brinell. The chemical analysis was OK. The NRC's lab could not conduct elongation or tensile tests on a 3/8 inch bolt. What does the 287 Brinell hardness mean?

S&L Response: With increasing hardness yield and fracture strength increases and ductility decreases. Increased hardness is advantageous from a strength point of view. Increased hardness also decreases ductility of the bolt material. However, as no impact loads are expected on HVAC ductwork, this decreased ductility does not affect the safety of the bolts.

Hence, increased hardness is beneficial.

Attached is a list of stresses on the bolts, obtained by conservative analysis of typical HVAC ductwork containing components (dampers, registers, grills, etc.).

Summary of findings for A307 bolts used in HVAC Duct. Companion flange analysis.

- Note: 1) The analysis was conservatively based on highest duct and duct component weights.
2) Analysis was based on 3/8 inch bolts.
3) Yield stress for A307 is minimum 36000 psi.

Building - Reactor 1 and 2

Service Level: Emergency

<u>Duct Size</u> (W X H inches)	<u>Calculated Stress</u> (ksi)	<u>Duct Size</u> (W X H inches)	<u>Calculated Stress</u> (ksi)
10 X 6	8.0	30 X 14	7.544
10 X 6	10.0	30 X 20	8.323
12 X 8	9.6	32 X 20	4.633
12 X 10	10.7	36 X 30	9.92
12 X 12	9.6	40 X 20	9.102
14 X 10	10.6	40 X 36	7.995
16 X 16	10.33	42 X 18	7.831
18 X 8	9.76	42 X 36	5.95
18 X 12	9.35	48 X 16	9.76
18 X 14	8.94	48 X 32	5.002
18 X 18	9.92	60 X 40	2.624
24 X 24	10.05	72 X 60	5.084
24 X 18	8.98	96 X 40	6.44
24 X 20	7.12		
26 X 12	8.16		
26 X 14	9.184		
26 X 20	9.963		
28 X 14	9.512		
28 X 20	9.061		

Building - Auxiliary

Service Level: Emergency

Duct Size
(W X H inches)

Calculated Stress
(ksi)

10 X 6	10.414
18 X 8	10.91
20 X 6	6.81
12 X 16	10.54
12 X 20	10.91
12 X 30	10.62
14 X 40	6.57
18 X 44	9.31
20 X 16	8.57
12 X 36	9.594
36 X 18	8.41
26 X 20	10.62
24 X 54	8.57
48 X 36	8.82
30 X 28	7.75
30 X 38	9.23
22 X 18	7.71
28 X 70	9.512
72 X 72	3.54
40 Ø	9.8
70 Ø	9.23

4

Building - Containment

Service Level: Emergency

Duct Size
(W X H inches)

Calculated Stress
(ksi)

12 X 24

8.16

32 X 10

8.1

30 X 32

8.364

18 Ø

9.27

Question 2: What are S&L's design factors for companion flanges and stiffeners?
flanges and stiffeners?

S&L Response: Between companion flanges and duct sheet metal, the sheet metal is the weaker member.

Stiffeners are not load carrying members. They are installed to prevent warping of the duct sheet metal. The stiffeners are installed to industry practice.

Question 3: Was A500 structural tubing ever added to HVAC Spec?

S&L Response: A500 tubing was approved for use by Field Change Request (FCR) 34,307. It will soon be incorporated into the HVAC Spec.

RESULTS OF SAMPLE ANALYSIS

Sample Number	ASTM* Material Type	System Removed From	System Component	Weight %				Tensile Strength, ksi	
				C	S	P	Mn	Calculated Min.	ASTM Min.
1	A36	VE	Hanger	0.19	0.035	0.008	0.68	-	58
2	A527	VC	Duct	0.07	0.027	0.005	0.38	N/A	N/A
3	A36	VC	Hanger	0.15	0.038	0.006	0.69	65	58
4	A575	VC	Stiffner	0.18	0.030	0.009	0.49	N/A	N/A
5	A36	VE	Hanger	0.23	0.038	0.012	0.68	-	58
6	A36	VE	Hanger	0.21	0.026	0.006	0.68	-	58
7	A527	VE	Duct	0.07	0.031	0.006	0.35	N/A	N/A
8	A575	VE	Stiffner	0.16	0.036	0.018	0.56	N/A	N/A
9	A36	VC	Hanger	0.18	0.029	0.006	0.75	69	58
10	A36	VC	Hanger	0.21	0.034 0.033	0.002	0.86	-	58
11	A36	VC	Hanger	0.20	0.041	0.027	0.58	-	58
12	A527	VX	Duct	0.06	0.019 0.018	0.005	0.41	N/A	N/A
13	A36	VX	Hanger	0.18	0.035	0.012	0.62	-	58
14	A36	VI	Hanger	0.16	0.035	0.006	0.65	65	58
15	A36	VX	Hanger	0.15	0.035	0.008	0.54	-	58
16	A36	VE	Hanger	0.19	0.046	0.023	0.73	65	58
17	A36	VX	Hanger	0.19	0.032	0.005	0.61	-	58
18	A575	VX	Companion Flange	0.22	0.031 0.032	0.017	0.38	N/A	N/A
19	A575	VD	Hanger	0.20	0.025	0.007	0.50	N/A	N/A

*All ASTM A575 Samples are specified to be Grade M2080, except sample #1 which was M1011

RESULTS OF SAMPLE ANALYSIS

Sample Number	ASTM* Material Type	System Removed From	System Component	Weight %				Tensile Strength, KSI	
				C	S	P	Mn	Calculated Min.	ASTM Min.
20	A527	VD	Duct	0.05	0.023 0.024	0.008	0.35	N/A	N/A
21	A575	VD	Companion Flange	0.23	0.026	0.005	0.52	N/A	N/A
22	A36	VD	Hanger	0.19	0.038	0.008	0.60	-	58
23	A36	VD	Hanger	0.19	0.036	0.009	0.68	64	58
24	A575	VD	Stiffener	0.20 0.19	0.026	0.008	0.61	N/A	N/A
25	A36	VY	Hanger	0.20	0.042	0.009	0.64	-	58
26	A575	VY	Stiffener	0.23	0.031	0.008	0.61	N/A	N/A
27	A36	VY	Hanger	0.17 0.18	0.037	0.007	0.56	-	58
28	A575	VY	Stiffener	0.21	0.029	0.008	0.58	N/A	N/A
29	A36	VY	Hanger	0.15	0.048	0.035 0.033	0.72	-	58
30	A36	VY	Hanger	0.21	0.030	0.009	0.72	-	58
31	A527	VD	Duct	0.08	0.02	0.006	0.42	N/A	N/A
32	A527	VD	Duct	0.05	0.02	0.009	0.30	N/A	N/A
33	A527	VD	Duct	0.06	0.02	0.006	0.43	N/A	N/A
34	A527	VY	Duct	0.06	0.03	0.007	0.28	N/A	N/A
35	A527	VY	Duct	0.06	0.02	0.007	0.28	N/A	N/A
36	A36	VY	Hanger	0.17 0.18	0.04	0.006	0.71	66	58

*All ASTM A575 Samples are specified to be Grade M1010, except sample 41 which was M1015.

RESULTS OF SAMPLE ANALYSIS

This is the bolt that is broken

Sample Number	ASTM* Material Type	System Removed From	System Component	Weight %				Tensile Strength, PSI	
				C	S	P	Mn	Calculated Min.	ASTM Min.
37	A527	VX	Duct	0.08	0.03	0.008	0.32	N/A	N/A
38	A307	VX	Bolt	-	0.03	0.011	0.69	145	60
39	A563	VX	Nut	0.05	-	0.009	0.39	97**	66**
40	A575	VX	Hanger	0.21	0.03	0.013	0.65 0.62	N/A	N/A
41	A575	VX	Stiffner	0.16	0.03	0.010	0.42	N/A	N/A
42	A575	VC	Hanger	0.19	0.04	0.018	0.44	N/A	N/A
43	A575	VC	Stiffner	0.19	0.04	0.012	0.32	N/A	N/A
44	A575	VC	Companion Flange	0.13 0.12	0.03	0.016	0.45	N/A	N/A
45	A527	VC	Duct	0.04	0.05 0.04	0.009	0.32	N/A	N/A
46	A527	VC	Companion Flange	0.14	0.04 0.03	0.016	0.42	N/A	N/A
47	A527	VE	Duct	0.09	0.02	0.006	0.40	N/A	N/A
48	A527	VC	Duct	0.07	0.03	0.011	0.33	N/A	N/A
49	A575	VC	Companion Flange	0.14	0.03	0.017	0.45	N/A	N/A
50	A575	VC	Companion Flange	0.13	0.03	0.017	0.46	N/A	N/A
51	A307	VX	Bolt	-	0.02	0.021	-	77	60
52	A563	VX	Nut	0.08	0.03	0.016	0.37	89**	61**

*All ASTM A575 samples are specified to be Grade M1020, except sample 41 which was M1015.

**Proof load stress.

I am sure we are off by 10 - 200 lbs. for some of what we need. what we need d.i.a.

RESULTS OF SAMPLE ANALYSIS

Sample Number	ASTM* Material Type	System Removed From	System Component	Weight %				Tensile Strength, KS	
				C	S	P	MoS ¹	Calculated Min.	ASTM Min.
53	A307	VX	Bolt	-	0.02	0.014	-	102	60
54	A563	VX	Nut	0.09	0.02	0.009	0.50	87**	68**
55	A307	VR	Bolt	-	0.02	0.031	-	96	60
56	A563	VR	Nut	0.11	0.01	0.026	0.34	107**	68**

*All ASTM A578 Samples are specified to be Grade M1020, except sample 41 which was M1015.

**Proof load stress.