October 5, 2011

Mr. Dale Martin
ROS Rack Repair
1025 Summit Hills Lane
Naperville, IL. 60563

Re: ROS Rack Repair Stub Column Testing
Packer Engineering Project No.: 502713

Dear Mr. Martin:

Packer Engineering was retained to perform stub column testing for ROS Rack Repair. The purpose of this testing was to verify and quantify the strength of the rack columns after they had been damaged and then repaired. All testing was performed in accordance with ANSI MH16.1:2008, Part VIII of the 1996 AISI Cold-Formed Steel Design Manual, and FEM 10.2.02.

ROS Rack Repair arranged for direct shipment from Interlake/Mecalux to Packer Engineering of (3) complete Interack 30 Welded F Punch Frame sections (48" maximum unsupported length). The model numbers **075** (13 gauge, 0.090" thick) and **077** (12 gauge, 0.105" thick) sections were used (see Figures 1-4). From material published by Interlake/Mecalux, the maximum total rack capacities are 30,600 lbs for the 075 model, and 35,200 lbs for the 077. Since these values are for complete rack sections, individual leg load capacities would be 15,300 and 17,600 lbs, respectively.

Packer Engineering cut twelve (12) equivalent sections of rack column supports for testing per FEM 10.2.02 section 5.3.2. These sections were to be 1200mm long, and within 1mm for overall squareness (+/- 0.5mm). Steel plates (approx. 100mm square and 9.5mm (3/8") thick), were welded onto each end for support during testing (Figure 5). The ends of the cut sections of rack were milled to be within specification requirements.

The next step in this project was to damage nine (9) of the twelve (12) rack sections, according to FEM 10.2.02 section 5.3.3. A Baldwin Universal Test Machine was used to damage the rack sections. The rack sections were supported on both ends horizontally by a fixture, and loaded in the center with a 100mm diameter cylinder (Figure 6). Loads input into the sections ranged from 3200 to 3400 lbs (1451 to 1542 kg), but dropped approximately 10% by the third damage load (Figure 7). It should be noted that each damage run used the same location. Table 1 summarizes the load data for each sample and trial. There was no discernable difference in the data by model for the samples tested.

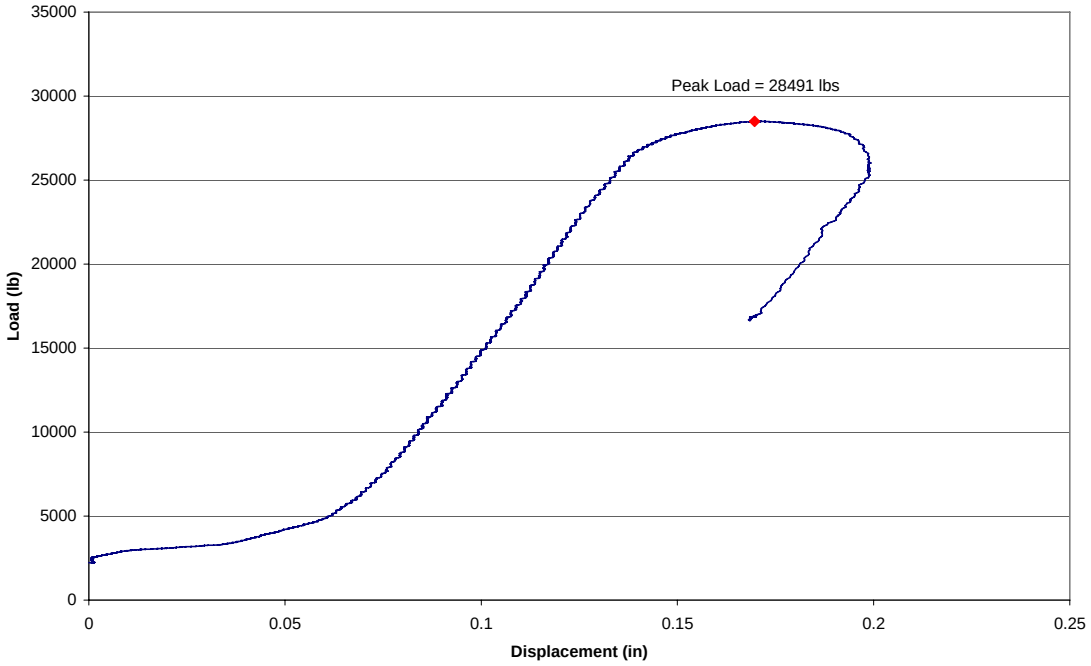
The next phase of testing was to compare the compression testing of undamaged sections of rack, to damaged and repaired sections, with some sections receiving up to three (3) repairs, also using FEM 10.2.02 section 5.3.3. A higher capacity Baldwin Universal Test Machine was used to load the rack sections longitudinally (Figure 8). A MTS load cell swivel assembly was used at the lower end of the rack to account for any lateral loading or lack of squareness (Figure 9). Undamaged sections had compressive loads ranging from 29,300 lbs (13,290 kg) to 32,649 lbs (14,809 kg). Damaged and repaired sections ranged from 28,491 lbs (12,923 kg) to 31,777 lbs (14,414 kg). Ref. Table 1 for a summary of the data.

Table 1 – ROS Rack Repair Summary Data

Sample #	Model #	1st Damage (lbs)	1st Repair	2nd Damage (lbs)	2nd Repair	3rd Damage (lbs)	3rd Repair	Compression Load (lbs)
1	075	3277	x					28491
2	075	3260	x					30690
3	077	3320	x					30876
4	075	3308	x	3214	x			28937
5	077	3407	x	3322	x			31777
6	075	3274	x	3169	x			30469
7	075	3266	x	3202	x	3030	x	29830
8	075	3301	x	3184	x	3053	x	30832
9	075	3252	x	3169	x	2962	x	30010
10	077							30985
11	077							29348
12	075							32649

During the compression loading of the rack sections the peak load was measured when the load versus displacement curve leveled off (see Chart 1). Peak loading was recorded the center area of the sections distorted and began to buckle (Figure 10).

Chart 1 – Sample 1 Compression Test



In summary, all the rack sections measured within 6% of the peak compressive load as compared to the undamaged and unrepaired sections, with most being within 2%. This is consistent with sections damaged and repaired up to three (3) times. Some sections saw an increase in compressive load capabilities with additional repairs, when evaluating on average values. When comparing the maximum compressive load capabilities of the tested rack sections to the published capabilities demonstrates that a safety factor of approximately 2 is evident even after multiple repairs are made, which is well within industry requirements and specification.

This concludes our report to date. Please feel free to contact Packer Engineering if further information is required.

Respectfully,

Timothy M. Hicks
Sr. Director of Engineering

APPENDIX A

Figure 1

Figure 2

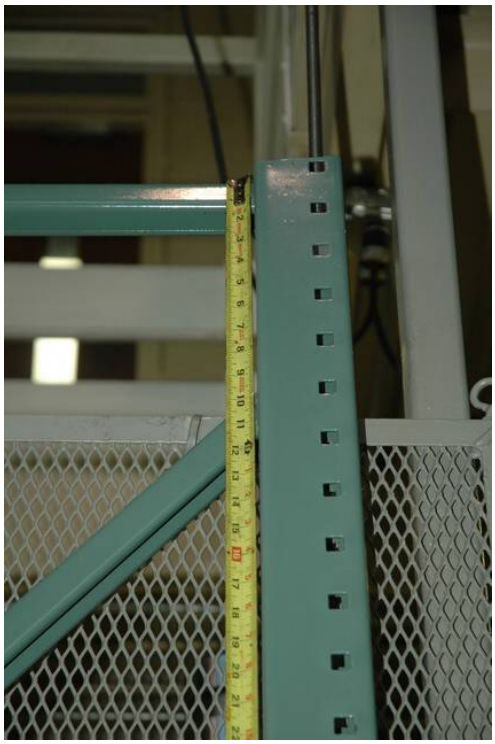


Figure 3

Figure 4

Figure 5

Figure 6

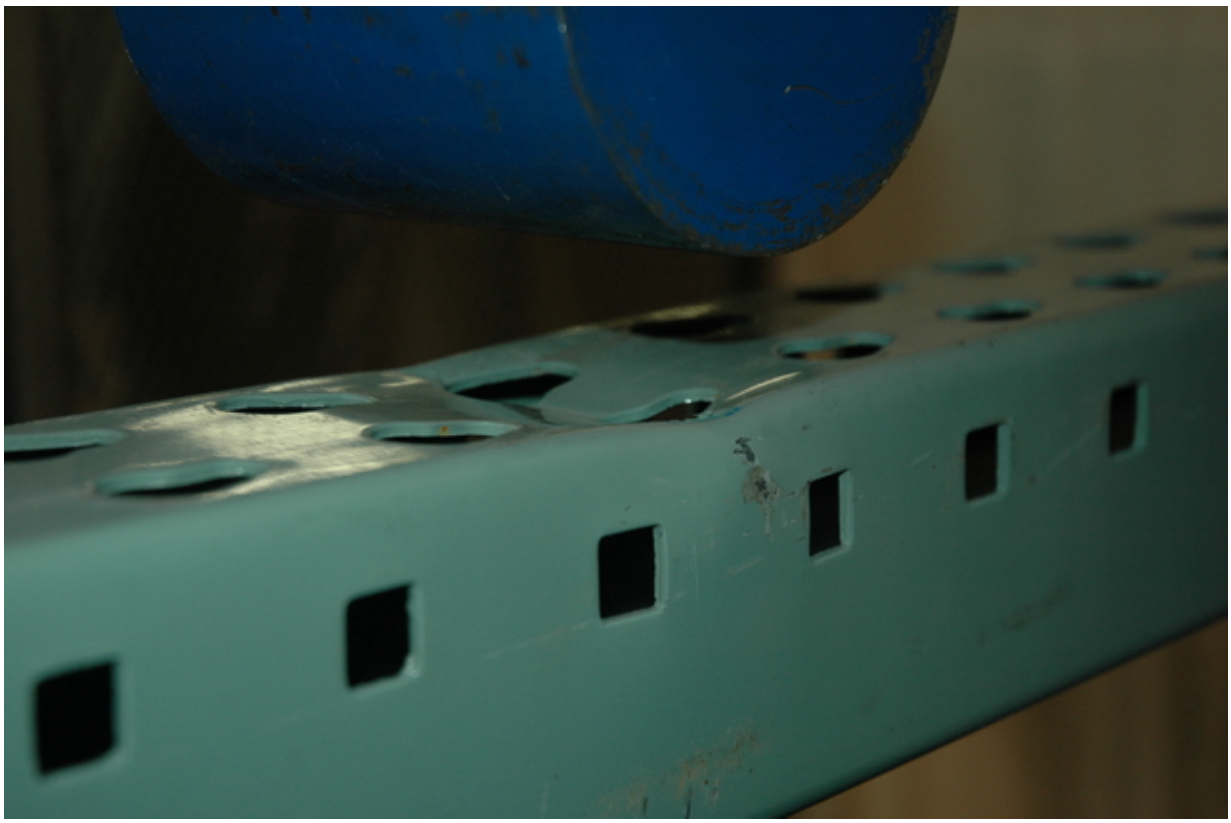


Figure 7

Figure 8

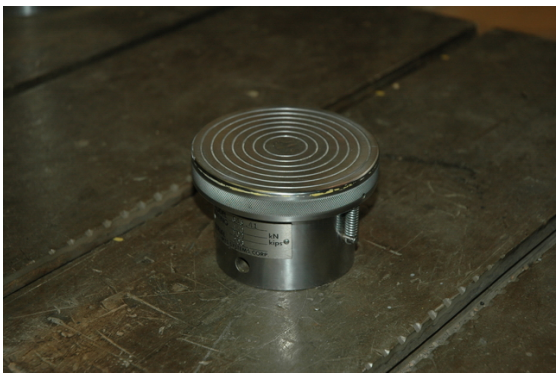


Figure 9

Figure 10