



## Proceedings of PVP2008

2008 ASME Pressure Vessels and Piping Conference  
July 27-31, 2008, Chicago, Illinois USA

**ONGOING WORK WITH PVP2007-26387 “DETERMINATION AND  
QUALIFICATION OF ALTERNATIVE FLANGE ASSEMBLY  
PROCEDURES” AND RESULTING GASKET RETORQUE DWELL  
PERIODS BASED ON ALTERNATIVE FLANGE ASSEMBLY  
PROCEDURES**



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# NAR Communications Team

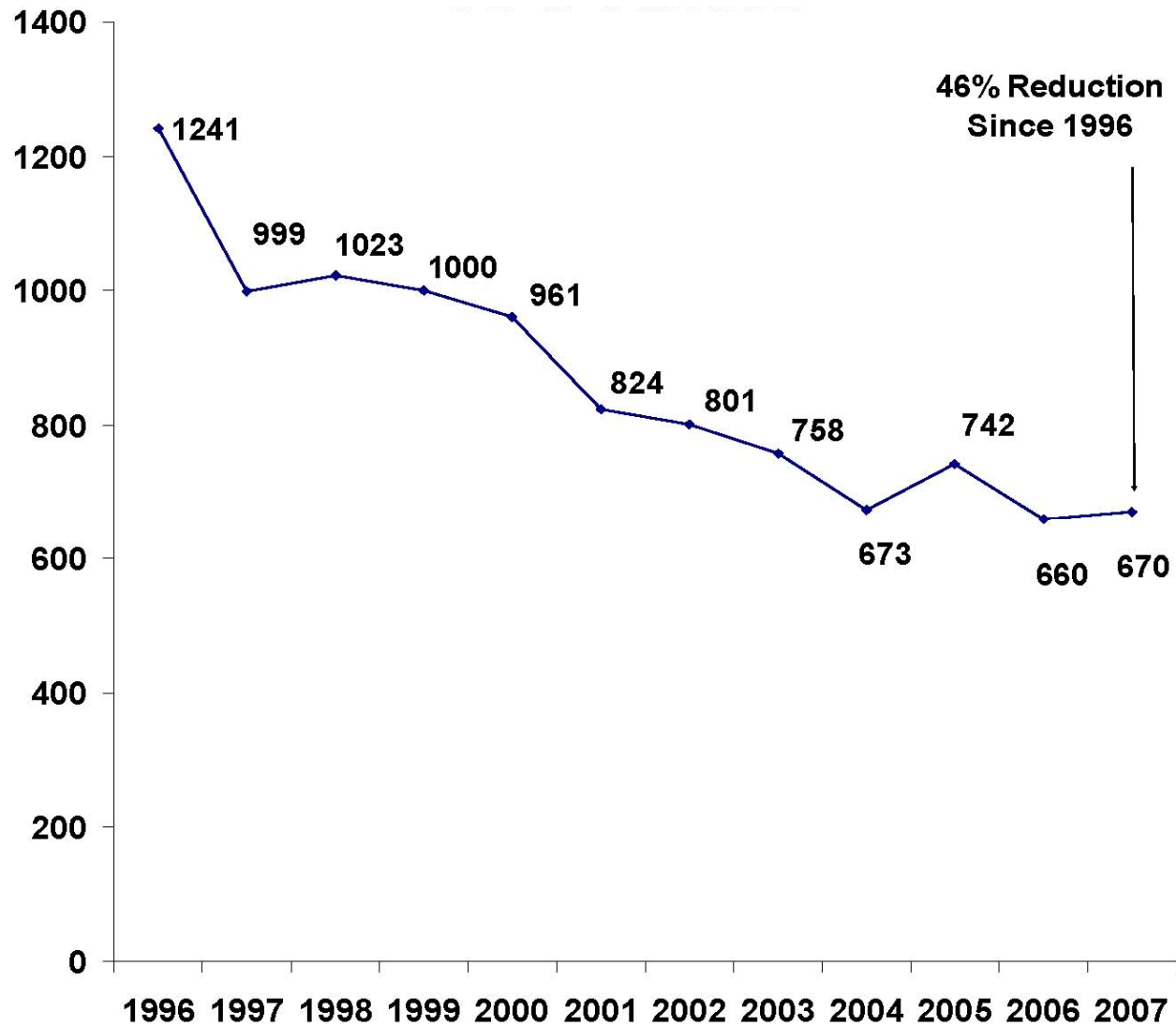
## Mission Statement

The NAR (Non Accident Release) Communication Committee's overall objective is to provide an information exchange hub with conduits to Shippers, Leasing Companies, Railroads, FRA, AAR, Industry Associations, and Suppliers, allowing for exchange of best practices information within the rail tank car industry. Our primary focus is communicating this information to aid in the prevention of NAR's.

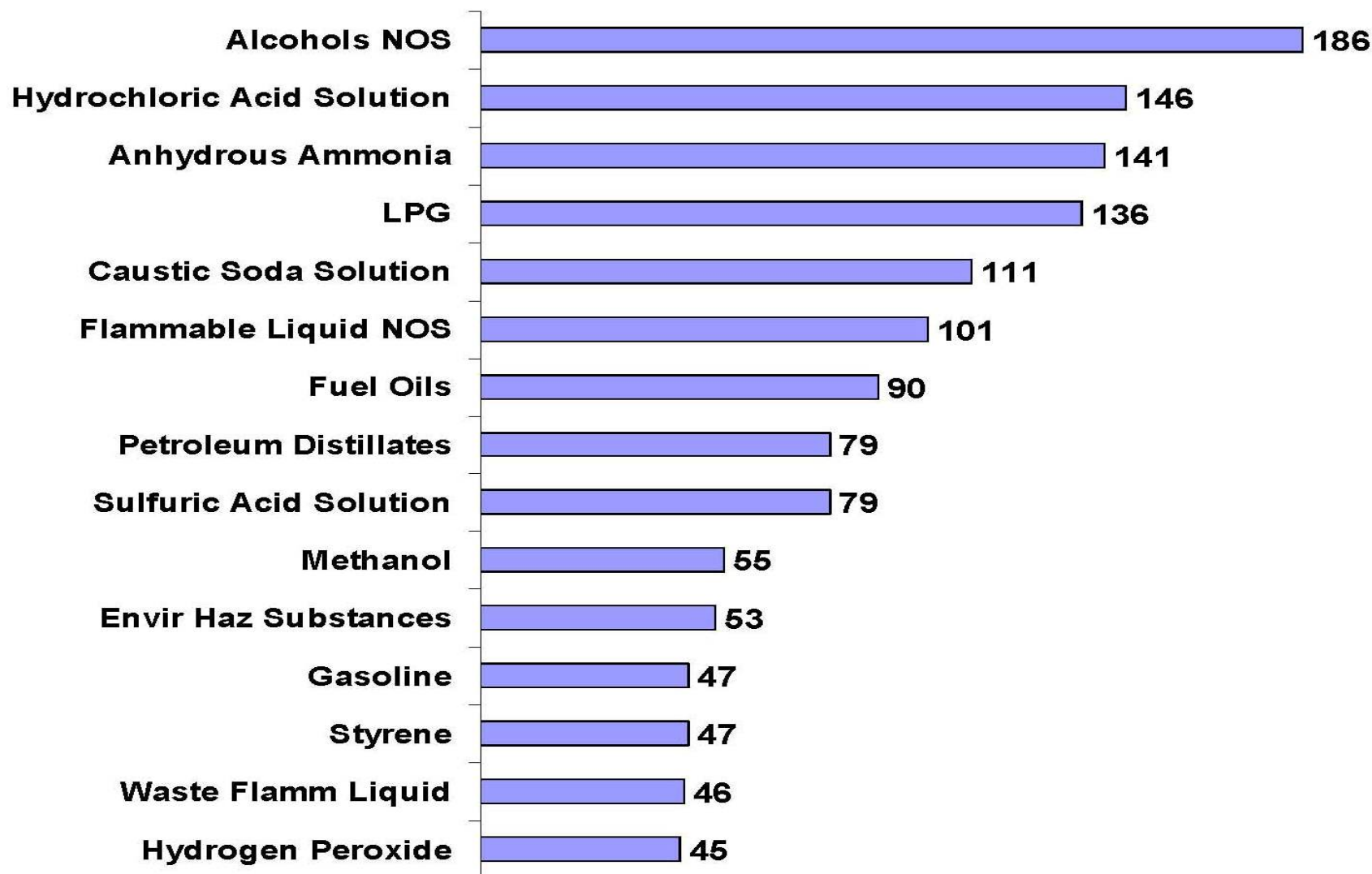


To Learn More About NAR Prevention Go To:  
<http://nar.aar.com>

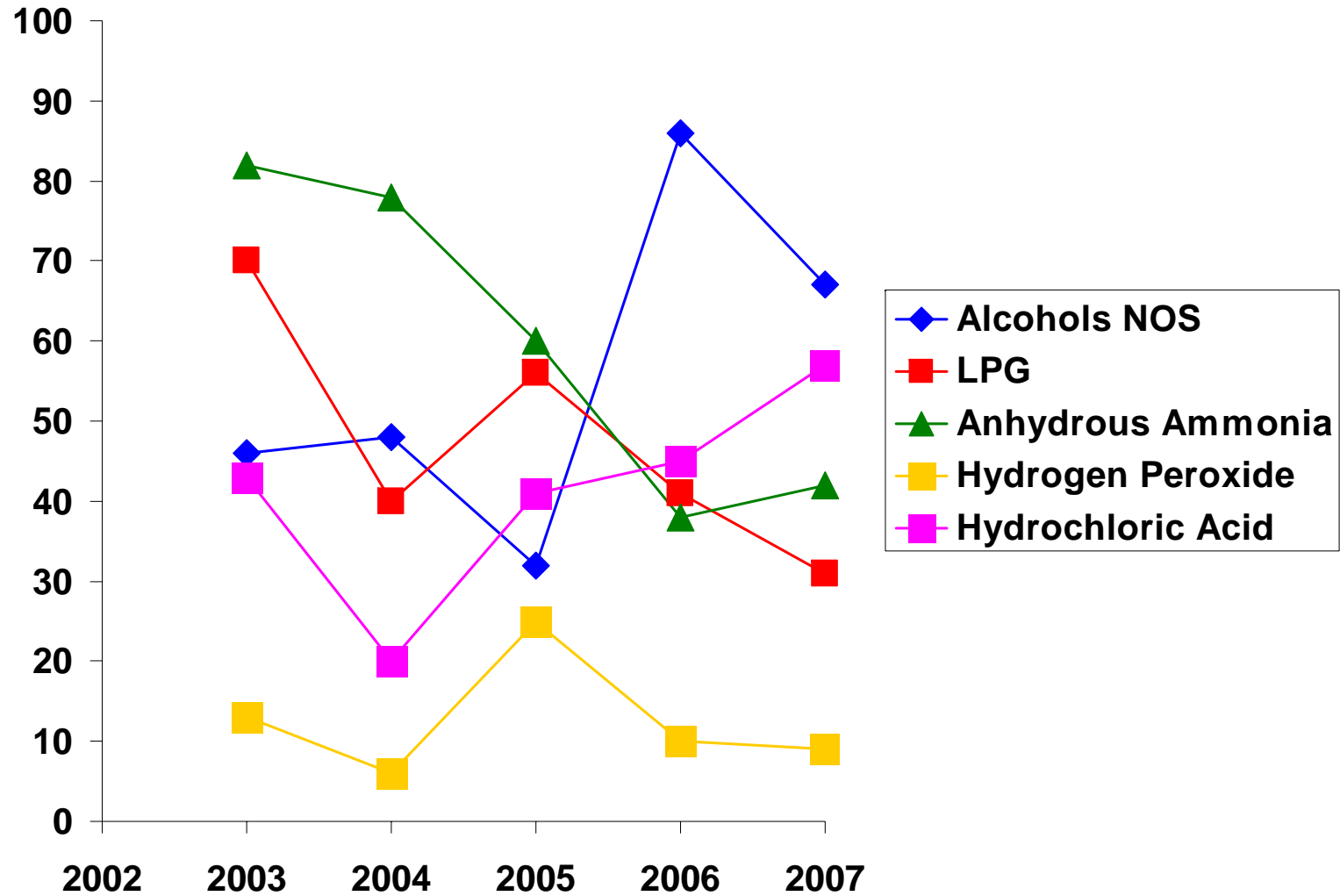
# NARs by Year: US & Canada



# Top Commodities for NARs 2005 - 2007



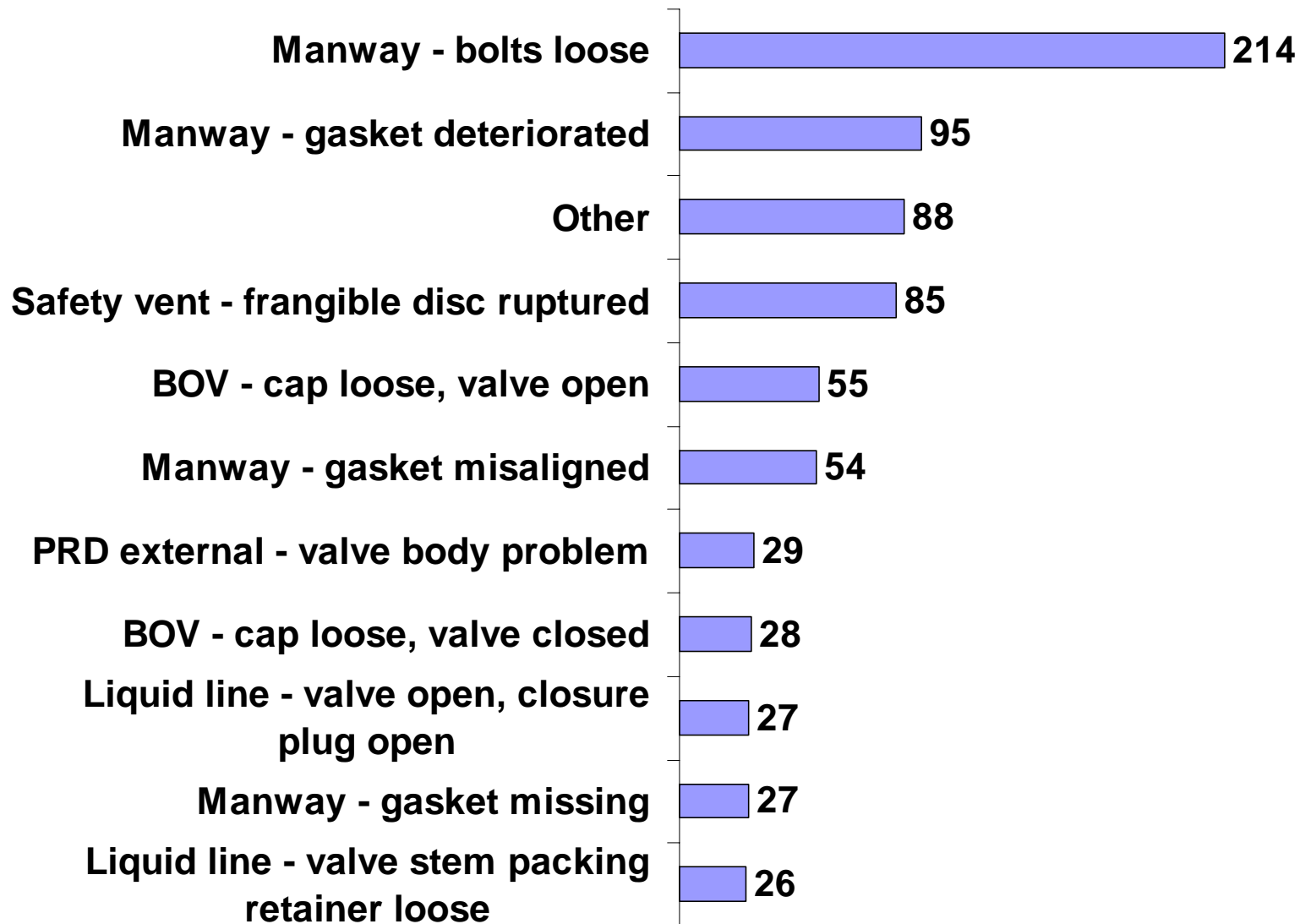
# Commodities with Trends of Interest



# Rail Industry Overview

- As a result of increased rail traffic, unless proper manway assembly procedures are developed and followed, manway related non-accident releases (NAR's) will continue to increase proportionate to increases in rail shipments. This is evident as ***manway connection failures have contributed significantly to the tank car hazardous materials NAR rate for more than a decade.***
- ***Non Accident Release (NAR) Tracking Results*** presented at the October 2007 Association of American Railroads (AAR) Meeting indicate ***GP Manway related NAR's represent over 50% of the "Top Specific Causes for Non-Pressure Cars".***
- Given the ***minimal bolt load*** available and the likelihood of ***GP Manway Gasket reuse*** proper Manway Assembly Procedures and gasket selection are of our utmost importance

# Top Specific Causes: Non-Pressure Cars 2004-06



## 20" GP Manway

- 20" GP Manway typically 6 or 8 bolts 7/8" or 1"
- NPS 20 Class 150 has (20 1-1/8" bolts)



## Gasket Material/Assembly Method

- Expanded PTFE w/316ss Corrugated Insert (white) - Torque Wrench
- Expanded PTFE w/316ss Corrugated Insert (white) - Alternative Assembly
- EPDM PC – 60 Durometer - Alternative Assembly
- Red Rubber -75 Durometer - Torque Wrench
- Red Rubber -75 Durometer - Alternative Assembly
- Buna-N(Nitrile) 60 Durometer - Confined
- Buna-N(Nitrile) 60 Durometer - Torque Wrench

# 1st and Final ALTERNATIVE ASSEMBLY PROCEDURE

## 1st

- Step 1 Clean & lubricate eyebolt threads and nut bearing surfaces
- Step 2 Starting with bolt #1, directly opposite from hinge, tighten nuts, until just snug, in a rotational pattern. Do not tighten past snug.
- Step 3 Step 3 Continue tightening in a rotational pattern for two complete rotations around manway, applying load for 5 seconds on each nut

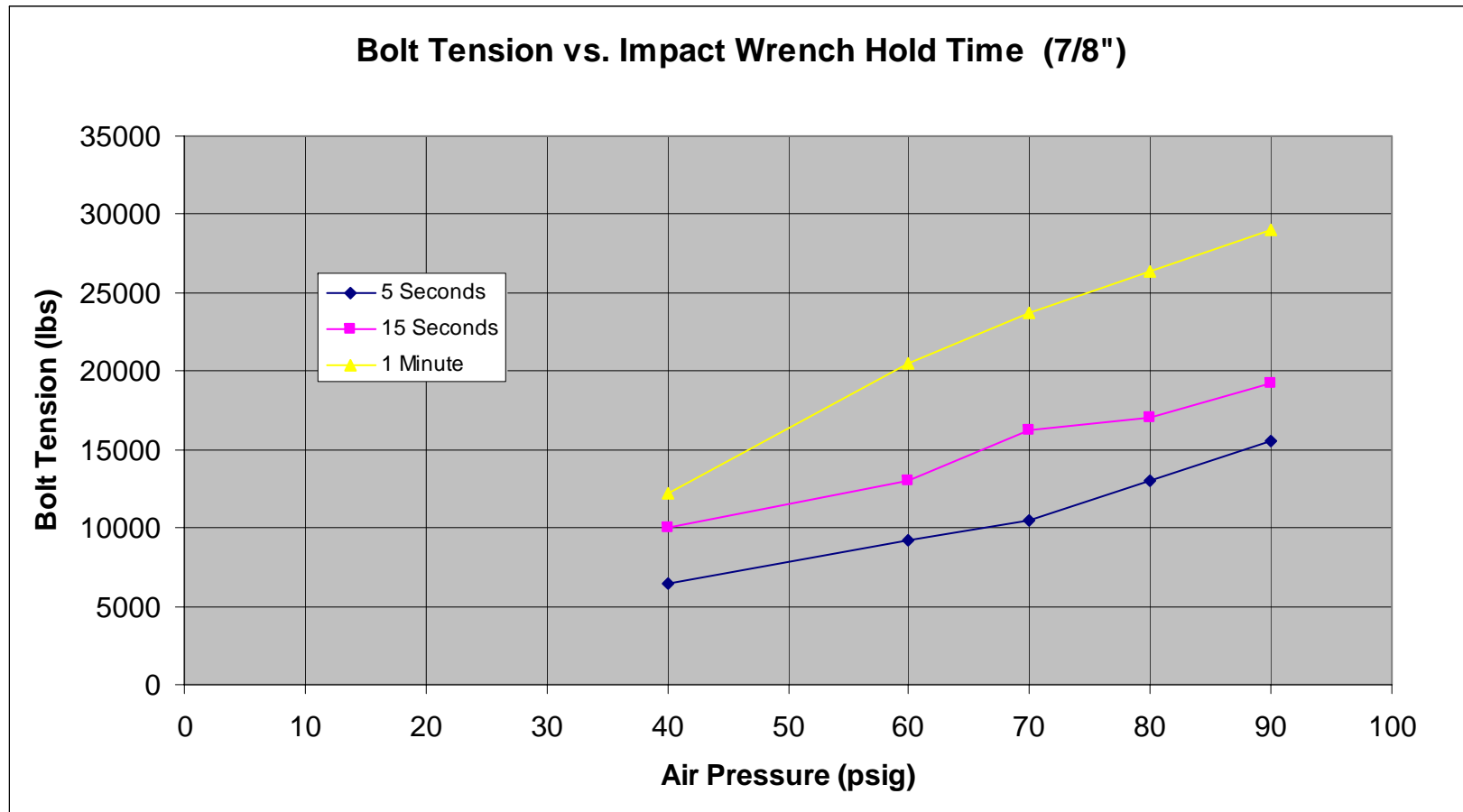
## Final

- Step 1 Clean & lubricate eyebolt threads and nut bearing surfaces
- Step 2 Starting with bolt #1, directly opposite from hinge, tighten nuts, until just snug, in a star pattern. Do not tighten past snug.
- Step 3 Starting with bolt #1, directly opposite from hinge, continue tightening in a star pattern, applying load for 5 seconds (1/2 Impact), or 2 seconds (3/4 Impact) on each nut
- Step 4 Step 4 Continue tightening in a rotational pattern for two complete rotations, applying load for 5 seconds (1/2 Impact), or 2 seconds (3/4 Impact) on each nut.

# Impact Gun Over Tightening of Manway

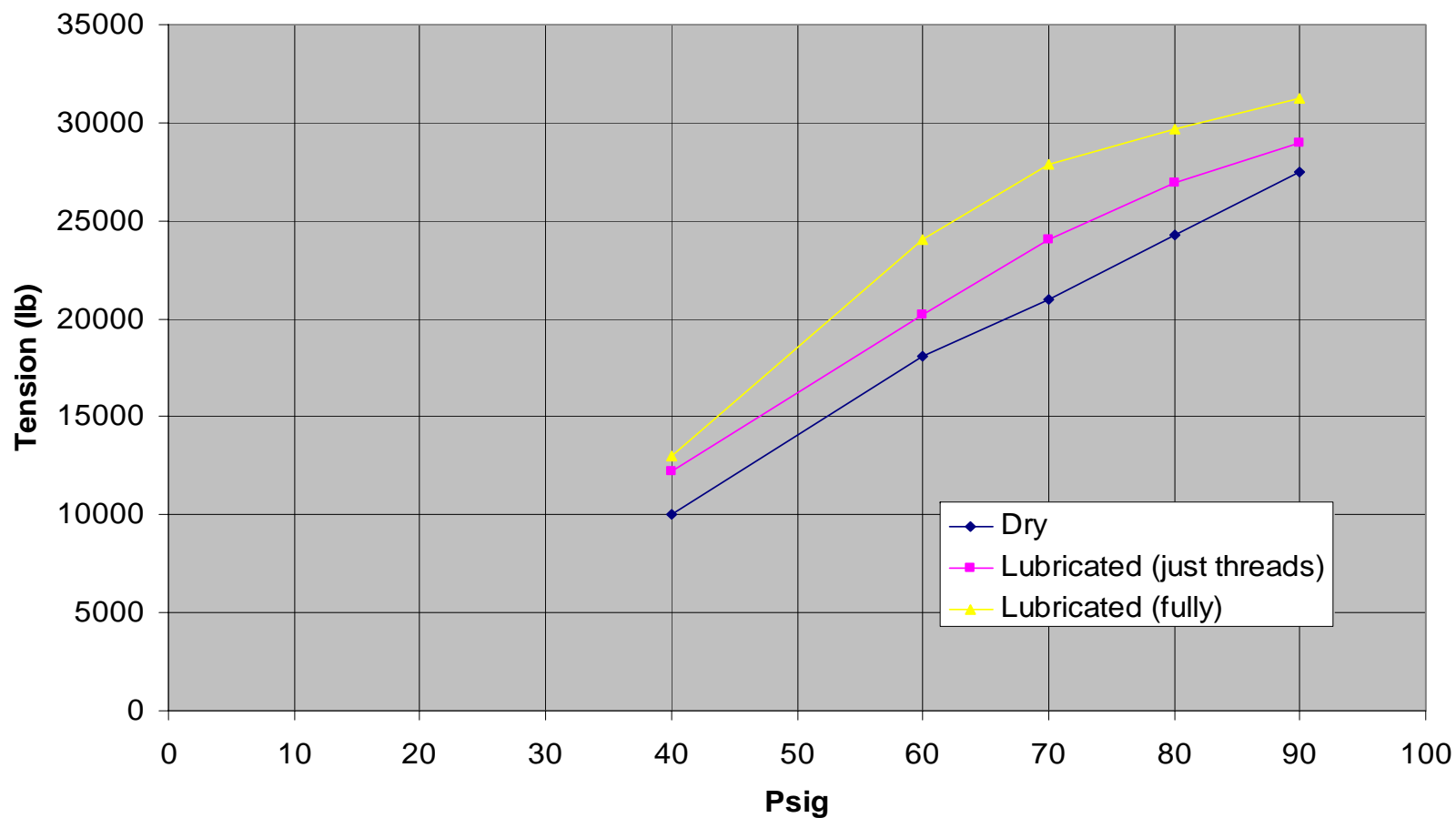


# Manway Assembly with Impact Gun



# Manway Assembly with Impact Gun

Bolt #2  
A193-B7 7/8"



# Manway Assembly with Impact Gun

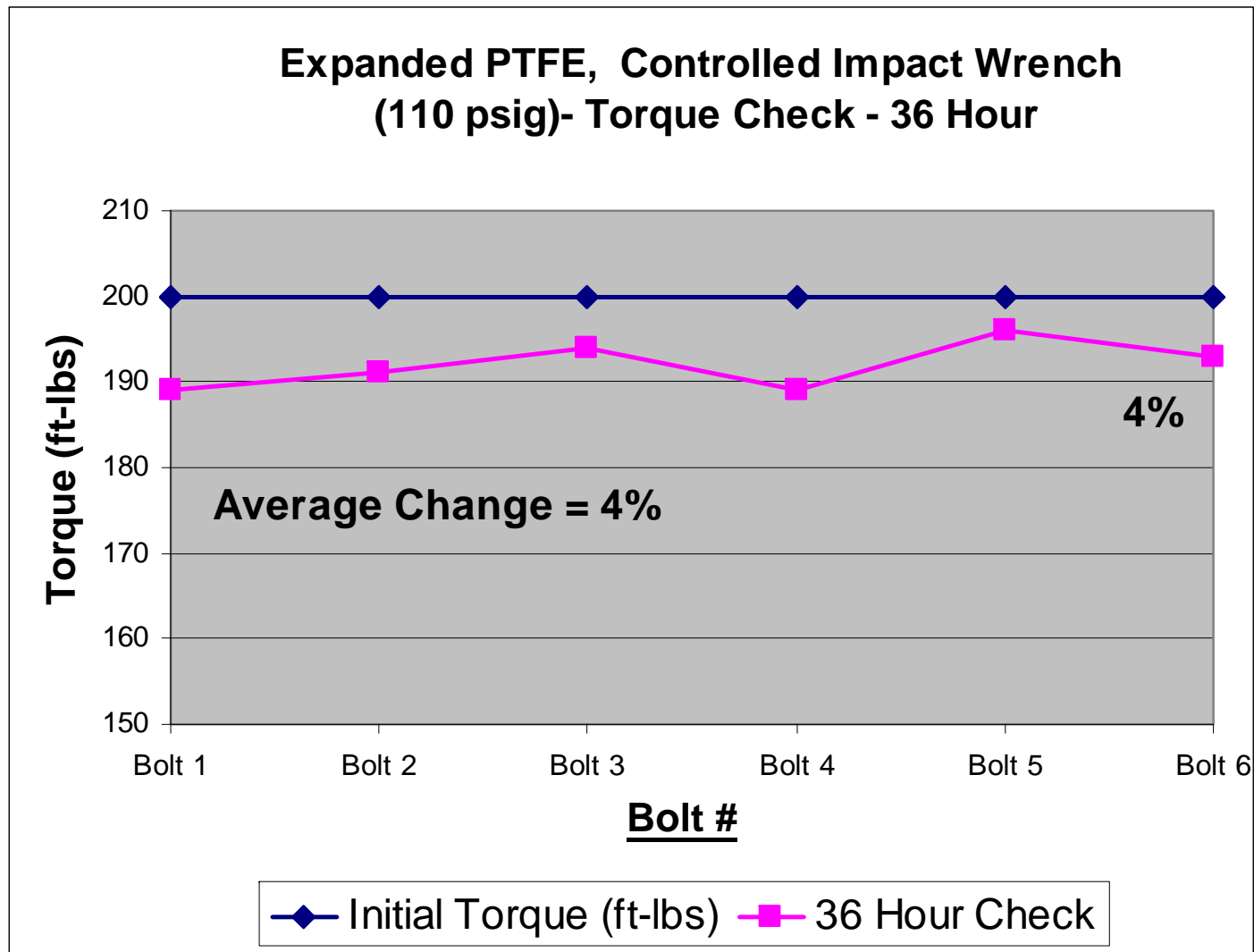


Lubricated Eyebolts 1 Pass  
Non-Uniform, Lower Overall  
Gasket Stress

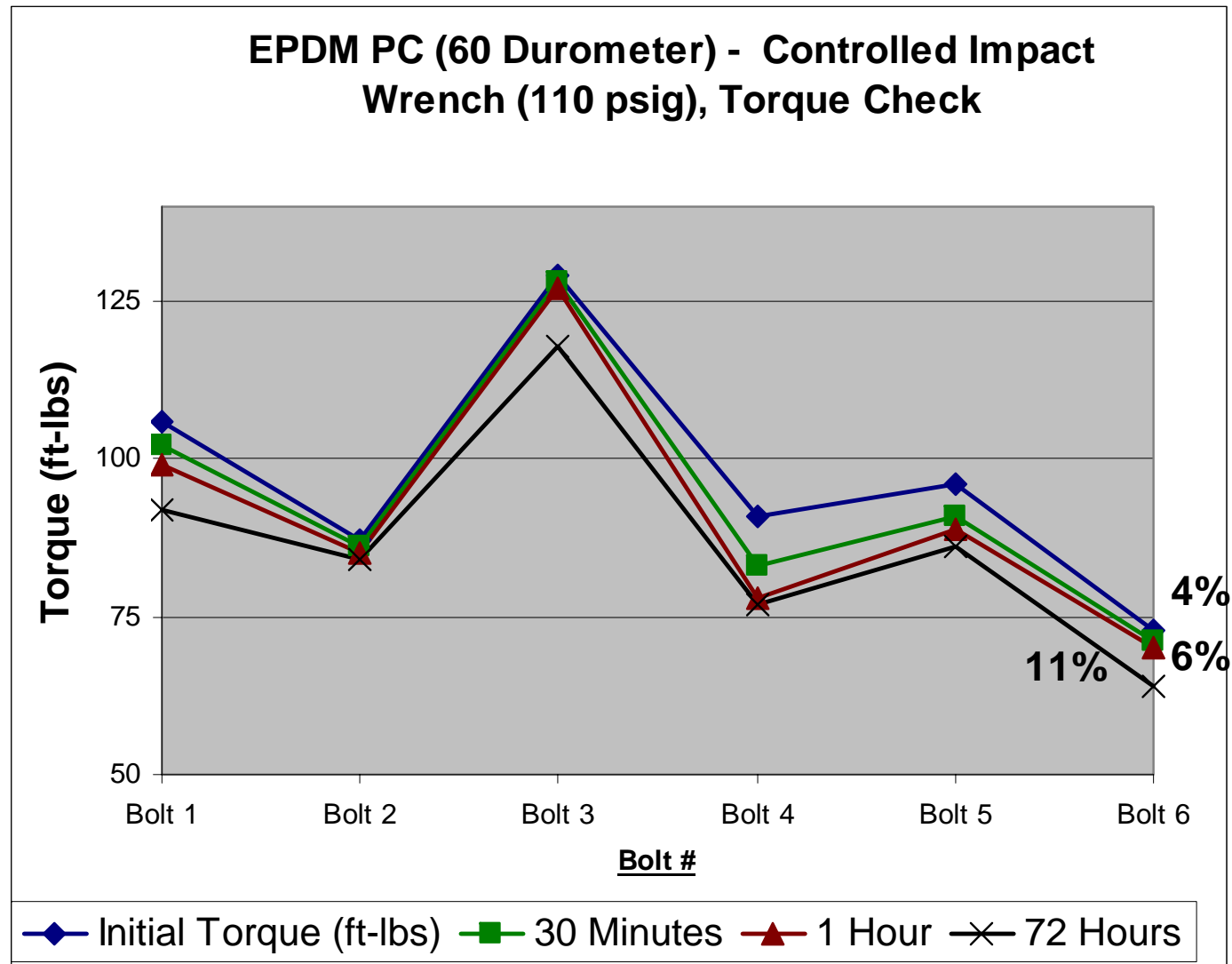


Lubricated Eyebolts w/Final Procedure  
More Uniform, Higher Overall  
Gasket Stress Developed

# Expanded PTFE Gasket with Impact Gun



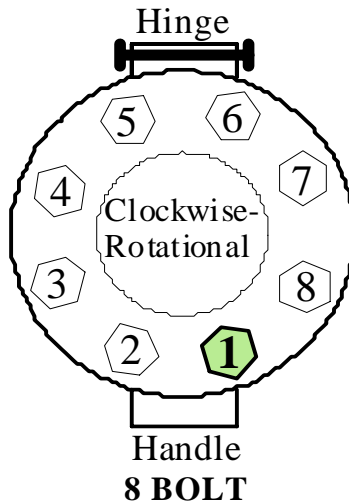
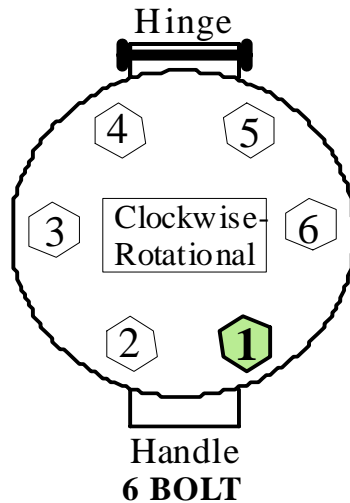
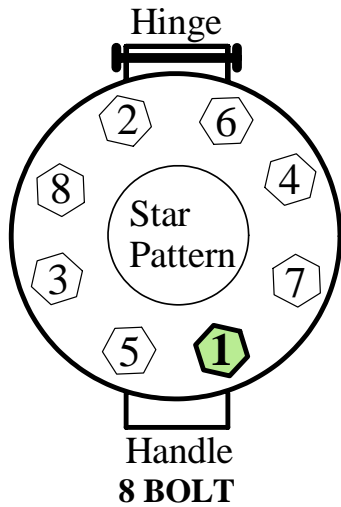
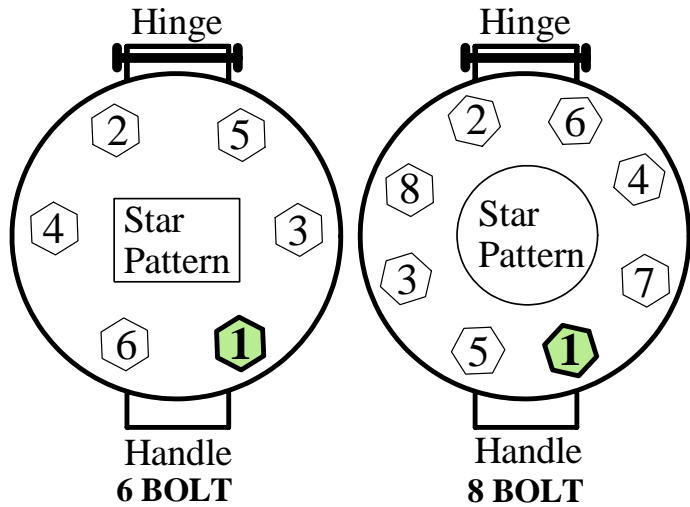
# Elastomeric Gasket with Impact Gun



# Over Compression of Gasket



# GP MANWAY CLOSURE WITH MANUAL TORQUE WRENCH



HARD GASKET, OR EXPANDED PTFE W/316SS CORRUGATED INSERT (WHITE)		
Sequence	6 Bolt	8 Bolt
Snug Pass (Star Pattern)	Snug	Snug
1 <sup>ST</sup> Pass (Star Pattern)	75 ft-lbs	70 ft-lbs
2 <sup>ND</sup> Pass (Star Pattern)	160 ft-lbs	140 ft-lbs
3 <sup>RD</sup> Pass (Star Pattern)	250 ft-lbs	200 ft-lbs
4 <sup>TH</sup> Pass (Clockwise/Rotational)	250 ft-lbs	200 ft-lbs
ELASTOMERIC GASKET		
Sequence	6 Bolt	8 Bolt
Snug Pass (Star Pattern)	Snug	Snug
1 <sup>ST</sup> Pass (Star Pattern)	50 ft-lbs	45 ft-lbs
2 <sup>ND</sup> Pass (Star Pattern)	80 ft-lbs	70 ft-lbs
3 <sup>RD</sup> Pass (Star Pattern)	115 ft-lbs	90 ft-lbs
4 <sup>TH</sup> Pass (Clockwise/Rotational)	115 ft-lbs	90 ft-lbs

# Manway Assembly with Torque Wrench

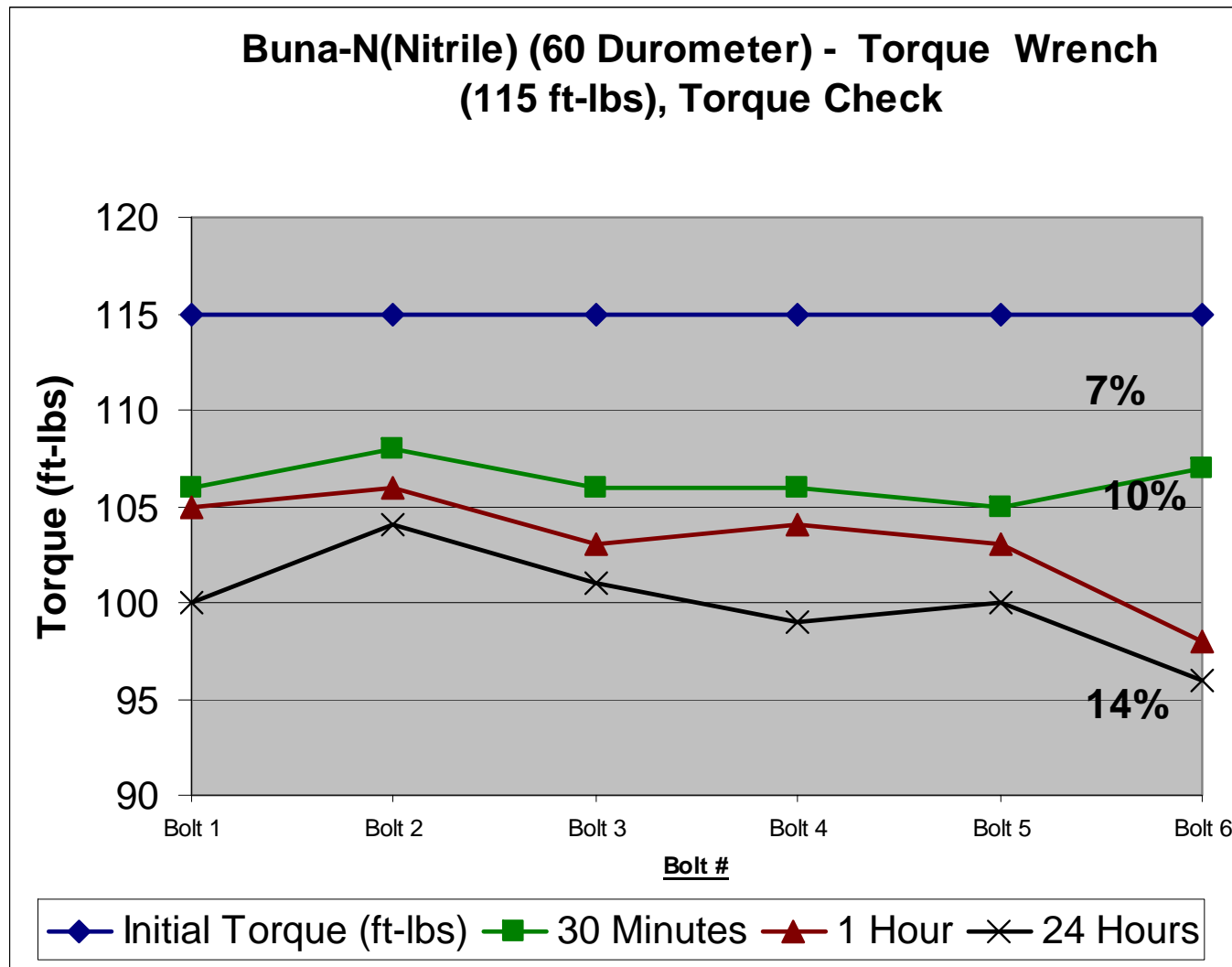


**Unlubricated Eyebolts**  
**Non-Uniform, Lower Overall  
Gasket Stress**



**Cleaned & Lubricated Eyebolts**  
**More Uniform, Higher Overall  
Gasket Stress Developed**

# Elastomeric Gasket with Torque Wrench



# Elastomeric Gasket with Torque Wrench



# CONCLUSIONS

- During the alternative assembly testing the expanded PTFE/316ss corrugated insert gasket performed considerably better compared to all of its elastomeric counterparts.
- The expanded PTFE/316ss gasket corrugated insert gasket only experienced a residual torque loss of 4% in a 36 hour period and a retorque is not required. .
- Elastomeric gaskets can begin to suffer from fracture/over compression in GP manway connections, even at the extremely low bolt torque/stress specified by shippers and manufacturers.
- Elastomers exhibit a slow, steady erosion of bolt load at the GP manway connection even at the low assembly torques specified and used in industry
- For Elastomeric gaskets fracture and erosion of bolt load occurs regardless of assembly method (conventional or alternative) and apparently independent of elastomer type or durometer.
- For Elastomeric gaskets it appears a retorque would be beneficial, but may not be practical given the operational aspects of railcar loading/unloading.
- The alternative assembly procedure has proven to be a viable option, but is dependent on the gasket material type chosen.
- Manway fluid sealing failures have contributed significantly to the tank car hazardous materials non-accident release (NAR) rate for more than a decade. The results from this study should be helpful to industry in applying an alternative controlled impact assembly procedure for GP manway Securement