The Nuts and Bolts of Zinc-Nickel

OEM Zinc Nickel Implementation on Fasteners – Getting It Into Production

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
NOV 2014		**00-00-2014 to 00-00-2014**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
The Nuts and Bolts of Zinc-Nickel: OEM Zinc Nickel Implementation on Fasteners - Getting It Into Production	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Boeing Research & Technology,Engineering, Operations & Technology,100 North Riverside,Chicago,IL,60606**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
ASETSDefense 2014: Sustainable Surface Engineering for Aerospace and Defense, 18-20 Nov 2014, Fort Myer, VA.

14. ABSTRACT

15. SUBJECT TERMS

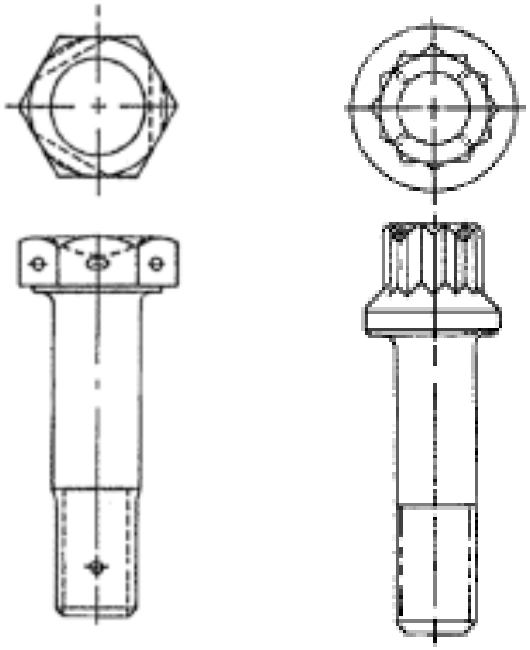
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**16**	

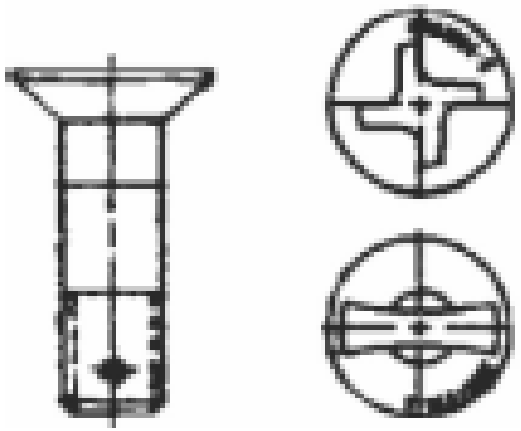
Agenda

1. **Cadmium Plated Fasteners currently in production**
2. **Problem at Hand – Hexavalent Chromates**
3. **Transition to Zinc-Nickel**
4. **Preliminary Testing**
5. **Plan moving forward for Qualifications and Implementation**

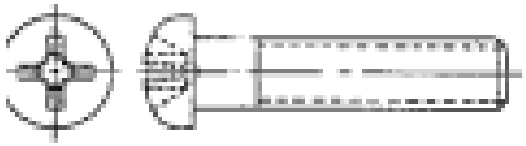
Cadmium Plated Fasteners

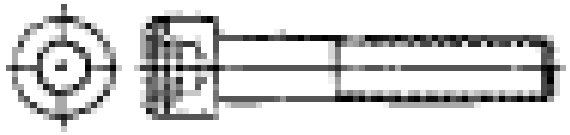
- **Bolts**





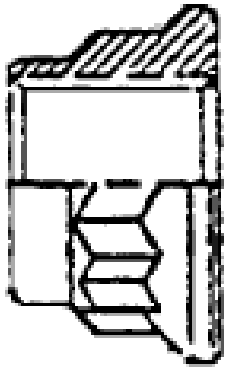
- **Screws**

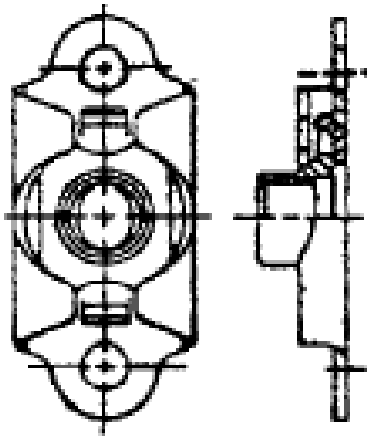




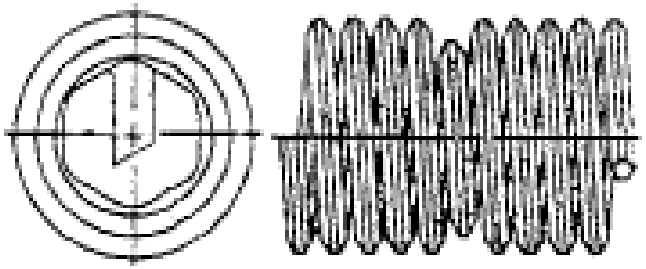
Cadmium Plated Fasteners

- **Nuts/Nut Plates**



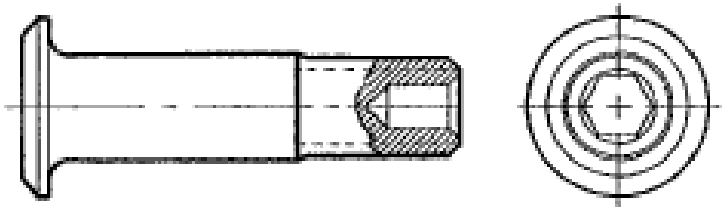


- **Inserts**

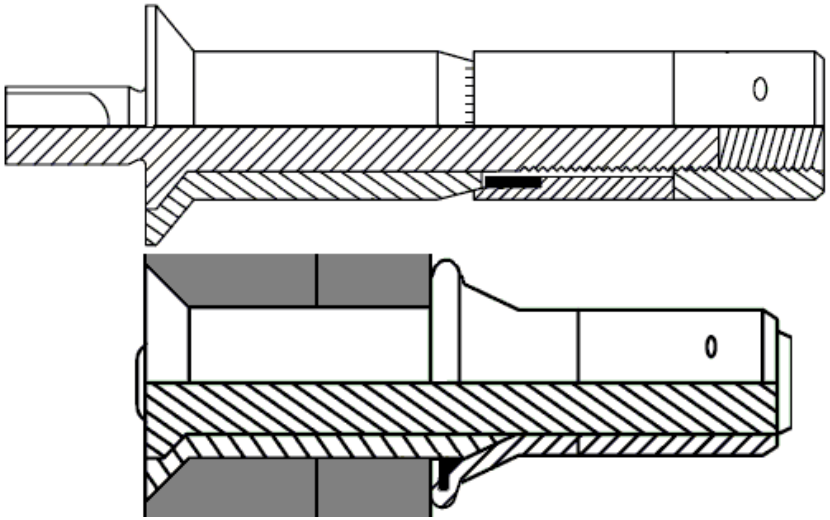


Cadmium Plated Fasteners

- **Hi-Loks**



- **Blind Fasteners**



REACH Initiative: Eliminate Hexavalent chromates

Zinc-Nickel Plating

Where is Zinc-Nickel used today?

- **Low Strength Steel – just about everywhere**
  - **Rod**
  - **Brackets**
  - **Baskets of Nut plates**
- **High Strength Steel**
  - **Landing gear**
  - **Flap tracks on wings**

So why not fasteners?

Threads

What has Boeing done in preparation?

Goal: Zinc-Nickel Plated Fasteners to be a drop-in replacement for CAD Plated Fasteners

Boeing Research and Technology conducted 6 phases of testing before moving into qualification and implementation phase of Zinc-Nickel plating of threaded fasteners.

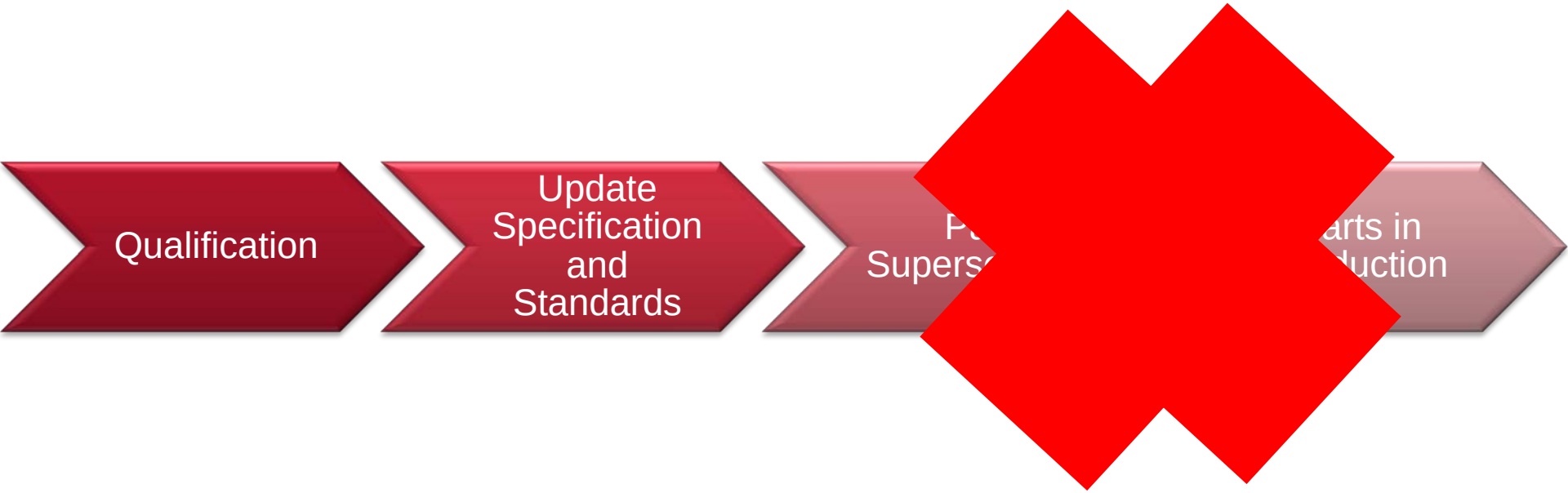
6 Phases of Testing

- **Phase I – Failed, Acid based Zinc-Nickel, Fasteners were not representative of fasteners used in production**
- **Phase II – Failed, Acid based Zinc-Nickel, Results were not acceptable. Switch to Alkaline based Zinc-Nickel**
- **Phase III – Failed, Alkaline based Zinc-Nickel, Results Unacceptable**
- **Phase IV – Failed, Alkaline based Zinc-Nickel, Coating too thick**
- **Phase V – Failed, Alkaline based Zinc-Nickel, parts were stripped and re-plated (altered data)**

Phase VI

1. **Metallurgical Testing - thickness check** **Comparable**
2. **Torque Tension – NASM1312-15** **Comparable, need more data**
   - **3 sizes, 6 tests configurations**
3. **High RPM Installation – galling check** **Comparable**
4. **Torque Effectively and Reusability – BPS-N-70** **Crimp Optimization needed**
5. **Salt Spray – NASM1312-1** **Comparable**
6. **Installation Force – BMS10-85** **Further investigation needed with interference fit fasteners**

What is the plan?



Qualification is not equal to Implementation

1. Structures and design community risk adverse
2. Immature supply chain

Where are we?

Qualifications in-process

1) **Bolts**
   - **Thickness**
   - **Appearance**
   - **Dimensions**
   - **Corrosion**

2) **Nuts**
   - **Thickness**
   - **Appearance**
   - **Dimensions**
   - **Torque Effectivity and Resuability – Adjust crimp factors**
   - **Additional Torque Tension to complete data set**

Next Steps

- **Continue qualifying fasteners (hi-loks, collars, blinds, nut plates, inserts)**
- **Complete specification changes**
- **Complete torque tension data package during the qualifications**
- **Slowly get parts into production (Start with low risk parts and increase confidence) and build the supply chain**

Questions???