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**Raj Raheja - Sargent & Lundy LLc**

**Chairman Subcommittee on**

**General Supports Services**

# ASME AG-1 Structural Design AA-4000 Code Interpretation

- **Structural Design Basis for Equipment and Components - Section AA-4000**
- **Environmental Qualification of Equipment - Presently Not Addressed (Under Consideration with Main Committee)**
- **Material Requirements addressed -Section AA-3000**
- **Each Equipment Code Section XA-4000 Addresses Design**
  - **for example**
  - **Fans Section BA**
  - **Dampers and Louvres Section DA**
  - **Instrumentation and Controls Section IA**

# Structural Design

- **Scope of AA-4000 - Addresses Minimum Requirements for Structural Design of CONAGT Equipment**
  - **Code Allows Various Methods for Qualifying Equipment:**
    - » **Analysis**
    - » **Testing**
    - » **Combination of Analysis and Testing**
- **Four Non - Mandatory Appendices in Section AA-4000 address:**
  - **Design and Qualification by Analysis**
  - **Qualification by Testing**
  - **Qualification by a Combination of Analysis and Testing**
  - **Design of Ductwork by Analysis**

# Requirements of a Design Specification

- **Reference CONAGT Code**
  - **for example**
  - **Fans Section BA**
  - **Dampers and Louvres Section DA**
- **Equipment Function and Safety Classification**
  - **Clearly describe whether the Equipment/Component is Active or Passive**
  - **Safety Related or Non-Safety- Related**
- **Equipment Loads**
  - **What loads are Applicable for the Design:**
    - » **Typical Loads - Dead, Live, Pressure, Temperature etc.**
    - » **Seismic Loads / Response Spectra or Time Histories**
    - » **Other Dynamic Loads, if applicable**
    - » **AA-4000 can be Invoked and Exceptions can be taken**

# Requirements of a Design Specification (Continued)

- **Environmental Conditions**
  - **State if applicable - What Standards should the Equipment be Qualified to**
    - » **IEEE 323 ; NUREG 0588 etc**
- **Acceptable Materials**
  - **Define the Acceptable Materials or Invoke the CONAGT Code Specific Equipment Sections**
  - **Refer to AA-3000 for Materials**
- **Design and Service Limits (Normal, Upset, Emergency and Faulted)**
- **Allowable Deflections or Clearances at Critical Sections of the Components**

# Load Conditions

- **For any Equipment/Component Four Service Levels to be Considered (Service Levels A,B,C and D)**
- **Component Service Levels and Associated Load Combinations**
- **Provided in Table AA-4212**

# Stress Limits

- **Plate and Shell Components (Table AA-4321)**
  - **Louvres and Dampers, Ductwork, Housings**
- **Linear - Type systems (Table AA-4323)**
  - **Supports**
- **Design of Bolts (AA-4360)**

# Functionality/Operability Requirements

- **Service Level C and D Stress Limits can be Reduced to Level B and C Respectively**
- **Verify in Accordance with Table AA-4231 and Buckling per Section AA-4323**
- **Testing**

# Design Verification by Testing AA-4350

- **Proof Testing**
  - **Testing for a Particular Application or Requirement**
- **Fragility Testing**
  - **Testing for Ultimate Capability to Perform its Safety Function**

# Frequently Asked Questions and Responses

- **Where are Applicable Loads Defined?**
  - **In the Equipment Specification - by the Owner**
- **What Load Combinations are Applicable for the Equipment?**
  - **Should be Defined in the Equipment Specification**
- **Are Design and Service Limits the Same?**
  - **No**
  - **Design Limit is the Maximum Stress that the Component can Endure and Remain Functional Prior to Failure**
  - **Service Limit is the Maximum Stress that the Component Experiences at each Service Level**

# Frequently Asked Questions and Responses (Continued)

- **When should Equipment be Qualified by Testing?**
  - **Structurally Complex Equipment that cannot be easily Modeled either as Linear Elements or Plates and Shells are Candidates for Testing - Refrigeration equipment,**
  - **Electrical Equipment that cannot be Modeled and for which Determination of Operability can Only be Determined by Testing - Motors, Transmitters**

- **Should the Design Specification Specify Equipment Environmental Qualification Requirements?**
  - **Yes - For Electrical and Active Mechanical Equipment in Plant "Harsh Areas"**