NORTHEAST NUCLEAR ENERGY COMPANY

SUBJECT Bonnet Pressure of the Containment Sump Recirculation Valves (2-CS-16.1A/B) 'Independent Review of CCN-2 to 89-078-873F.S rev. 0)	BY P. S. Higgins DATE 7/27/95
	CHKD. BY DATE
	CALC. NO. REV.
	SHEET NO. 1 OF 8

QA Category 1

Calculation: 89-078-1206M2 rev. 0

Title: Millstone Unit nc 2
Bonnet Pressure of Containment Sump
Recirculation Valves (2-CS-16.1A/B)

Prepared by: [signature]
Phillip Higgins

Date: 7/27/95

Method of Review:

THE ABOVE CALCULATION CHANGE NOTICE (CCN) WAS FULLY REVIEWED. INPUT & CALC METHODOLOGY WAS REVIEWED AND SHOWN TO BE ACCURATE AND REASONABLE.

I. Purpose

This calculation determines the the required thrust to open the sump recirculation valves (2-CS-16.1A/B)based upon expected design basis accident conditions seen by the valves. The calculation provides an independent review of the referenced calc using the EPRI Performance Prediction Program Methodology for evaluating Parallel disc gate valve (EPRI TR-103244)

II. Results

Four scerious were reviewed for the valve with most limiting conditions (CS-16.1A). The four cases were: 1) pre-accident conditions; 2)large break loca, 44 minutes into the accident; 3)small break loca 4 hours into the accident w/presssurized bonnet; 4)small break loca 4 hours into accident w/bonnet pressure equal to down stream piping.

Using the "double drag" method which applies forces to both discs on the seat ring, the valves are able to open using design basis limits.

III. References

(1) Crane Technical Paper # 410
(2) A. Nusco dwg 25203-26015 sh.

(3) EPRI TR-103244, "EPRI Performance Prediction Program"

IV. Conditions & Assumptions

See section 1.0, Purpose

V. Method

1. The sealing force is determined using EPRI PPP guideline for A/D Double Disc valve and info from the as-left static test. This sealing force is compared to force required for the valve to make the valve leak tight.

2. The force required to open the valves during: 1)pre-accident conditions; 2)large break loca, 44 minutes into the accident; 3)small break loca bonnet pressurization; 4)small break loca with bonnet pressure equalized to the downstream pressure.

VI. ANALYSIS

VI.1 Determine the Sealing Force

Step 1:Determine Disk Assembly and Stem Weight

$Fw := 0 \cdot lbf$ ...not needed (included in packing/running load)

Step 2: Determine Packing Friction Stem Thrust

$Fpack := 4634 \cdot lbf$ ... packing load from CS-16.1A is bounding and used for both valves(see memo MOV-95-391, dated 7/27/95)

Step 3: Determine Piston Effect Stem Thrust

$Dstem := 2.25 \cdot in$

$P := 37 \cdot psi$

$Fp := P \cdot \frac{\pi \cdot Dstem^2}{4}$ $Fp = 147 \cdot lbf$

Step 4: Determine Torque Reaction Factor

$B2 := 24.021 \cdot in$ ...seat ring OD
$B3 := 23.387 \cdot in$ ...seat ring ID

$Rt := 0.5 \cdot \frac{B2 + B3}{2}$

$Rt = 0.988 \cdot ft$

$FS := 0.0226 \cdot ft$

$\mu t := 0.54$

$TRF := 1 - \left(\mu t \cdot \frac{FS}{Rt}\right)$ $TRF = 0.988$

Step 5: Determine Actual Sealing Force

$Adp := \frac{\pi \cdot \left(\frac{B2 + B3}{2}\right)^2}{4}$ $Adp = 441 \cdot in^2$

$Rstatic := 29225 \cdot lbf$ ...latest as-left static test TT

$\Delta Pclose := 0 \cdot psi$ ...assumed for static test closure

$Ra := 0.5 \cdot Rstatic + 0.6 \cdot Adp \cdot \Delta Pclose$ $Ra = 14613 \cdot lbf$

Contact Force vs. DP Force

$Acontact := \frac{\pi \cdot \left(B2^2 - B3^2\right)}{4}$ $Acontact = 23.606 \cdot in^2$

$Pcontact := \frac{Ra}{Acontact}$ $Pcontact = 619 \cdot psi$

Contact stress required for leak tightness is 4000 psi, thus valve is not considered leak tight.

Step 6: Determine Differential Pressure Stem Thrust(Fdp)

Case 1: Large Break Loca (Time = 0 minutes)

$Pbonnet := 37 \cdot psi$

$Pdnstream := 37 \cdot psi$

$Pupstream := 2 \cdot psi$

$\Delta Pupstream := Pbonnet - Pupstream$

$\Delta Pdnstream := Pbonnet - Pdnstream$

$Fbn := 1$ ...bernoulli force correction factor (assumed negligible)

$Fdp\_upstream := Adp \cdot \Delta Pupstream \cdot \mu s \cdot Fbn$ $Fdp\_upstream = 8341 \cdot lbf$

$Fdp\_dnstream := Adp \cdot \Delta Pdnstream \cdot \mu s \cdot Fbn$ $Fdp\_dnstream = 0 \cdot lbf$

$Fdp := Fdp\_upstream + Fdp\_dnstream$ $Fdp = 8341 \cdot lbf$

Step 7: Determine Required Thrust for Opening the Valve(Fr)

$$Fr := \frac{Fw + Fpack + Fp + Fdp}{TRF}$$

...where

$Fw = 0 \cdot lbf$ ...included in packing load

$Fpack = 4634 \cdot lbf$

$Fp = 147 \cdot lbf$

$Fdp = 8341 \cdot lbf$

$Fr = 13286 \cdot lbf$ $<$ $Tlimit := 18025 \cdot lbf$ Thus, Satisfactory

Step 6: Determine Differential Pressure Stem Thrust(Fdp)

Case 2: Large Break Loca (Time = 44 minutes)

$Pbonnet := 37 \cdot psi$

$Pdnstream := 20 \cdot psi$

$Pupstream := 15 \cdot psi$

$\Delta Pupstream := Pbonnet - Pupstream$

$\Delta Pdnstream := Pbonnet - Pdnstream$

$Fbn := 1$ ...bernoulli force correction factor (assumed negligible)

$Fdp\_upstream := Adp \cdot \Delta Pupstream \cdot \mu s \cdot Fbn$ $Fdp\_upstream = 5243 \cdot lbf$

$Fdp\_dnstream := Adp \cdot \Delta Pdnstream \cdot \mu s \cdot Fbn$ $Fdp\_dnstream = 4051 \cdot lbf$

$Fdp := Fdp\_upstream + Fdp\_dnstream$ $Fdp = 9294 \cdot lbf$

Step 7: Determine Required Thrust for Opening the Valve(Fr)

$$Fr := \frac{Fw + Fpack + Fp + Fdp}{TRF}$$

...where

$Fw = 0 \cdot lbf$ ...included in packing load

$Fpack = 4634 \cdot lbf$

$Fp = 147 \cdot lbf$

$Fdp = 9294 \cdot lbf$

$Fr = 14251 \cdot lbf$ < $Tlimit := 18025 \cdot lbf$ Thus, Satisfactory

Step 6: Determine Differential Pressure Stem Thrust(Fdp)

Case 3: Small Break Loca (Time = 4 hours, bonnet pressurized)

$Pbonnet := 37 \cdot psi$

$Pdnstream := 20 \cdot psi$

$Pupstream := 10 \cdot psi$

$\Delta Pupstream := Pbonnet - Pupstream$

$\Delta Pdnstream := Pbonnet - Pdnstream$

$Fbn := 1$ ...bernoulli force correction factor (assumed negligible)

$Fdp\_upstream := Adp \cdot \Delta Pupstream \cdot \mu s \cdot Fbn$ $\quad Fdp\_upstream = 6434 \cdot lbf$

$Fdp\_dnstream := Adp \cdot \Delta Pdnstream \cdot \mu s \cdot Fbn$ $\quad Fdp\_dnstream = 4051 \cdot lbf$

$Fdp := Fdp\_upstream + Fdp\_dnstream$ $\quad Fdp = 10485 \cdot lbf$

Step 7: Determine Required Thrust for Opening the Valve(Fr)

$$Fr := \frac{Fw + Fpack + Fp + Fdp}{TRF}$$

...where

$Fw = 0 \cdot lbf$ ...included in packing load

$Fpack = 4634 \cdot lbf$

$Fp = 147 \cdot lbf$

$Fdp = 10485 \cdot lbf$

$Fr = 15457 \cdot lbf$ $<$ $Tlimit := 18025 \cdot lbf$ Thus, Satisfactory

Step 6: Determine Differential Pressure Stem Thrust(Fdp)

Case 4: Small Break Loca (Time = 4 hours, bonnet pressure = downstream pressure)

$Pbonnet := 20 \cdot psi$

$Pdnstream := 20 \cdot psi$

$Pupstream := 10 \cdot psi$

$\Delta Pupstream := Pbonnet - Pupstream$

$\Delta Pdnstream := Pbonnet - Pdnstream$

$Fbn := 1$ ...bernoulli force correction factor (assumed negligible)

$Fdp\_upstream := Adp \cdot \Delta Pupstream \cdot \mu s \cdot Fbn$ $Fdp\_upstream = 2383 \cdot lbf$

$Fdp\_dnstream := Adp \cdot \Delta Pdnstream \cdot \mu s \cdot Fbn$ $Fdp\_dnstream = 0 \cdot lbf$

$Fdp := Fdp\_upstream + Fdp\_dnstream$ $Fdp = 2383 \cdot lbf$

Step 7: Determine Required Thrust for Opening the Valve(Fr)

$$Fr := \frac{Fw + Fpack + Fp + Fdp}{TRF}$$

...where

$Fw = 0 \cdot lbf$ ...included in packing load

$Fpack = 4634 \cdot lbf$

$Fp = 147 \cdot lbf$

$Fdp = 2383 \cdot lbf$

$Fr = 7254 \cdot lbf$ < $Tlimit := 18025 \cdot lbf$ Thus, Satisfactory

REF. 5

MP-2

Portions from SP 21136, Rev. 9

Procedure to monitor and fill containment sump piping to prevent pressure locking of 2-CS-16.1 A/B

TABLE OF CONTENTS

Ch 15

Ch 14 Change 4

chg 15

chg 15

Ch 14