CANDU MAINTENANCE CONFERENCE 1995

CONTROL VALVE FRICTION OPERATIONAL EXPERIENCE AT DARLINGTON NGD

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ABSTRACT

Proper installation of valve packing is an important part of ensuring that control valves operate as intended. Darlington NGD has developed a Valve Packing Program. This program combined with valve diagnostics has enabled the station to ensure that the operability of control valves is maintained after repacking. This paper outlines the process that is used for this.

INTRODUCTION

Darlington NGD is a four unit CANDU nuclear power station located on the north shore of Lake Ontario approximately forty miles east of Toronto. Each unit is rated to 881 MW (net) for a total of 3,520 MW. The first unit went into commercial operation in 1989.

This paper is intended to share the experience from the station with regard to repacking of control valves and the use of valve diagnostics to ensure good setup. It is important to note that this is a personal opinion based on experience.

The paper is broken down into the following sections.

1.0 Packing
An overview of valve packing

2.0 Control Valve Friction
A listing of typical areas of friction in control valves

3.0 Valve Program

3.1 Communication
Levels required

3.2 Packing Program
Applying packing program to control valves

3.3 Diagnostics
Applying diagnostics to repacked control valves

4.0 Packing Improvements
Discussion of improvements made at Darlington

5.0 Summary

1.0 PACKING

In the simplest terms valve packing is required to provide a seal around the valve stem to prevent the fluid inside the valve from leaking out. This application would be a very simple if it were not for the valve stem having to move through the packing so now you are attempting to seal on a moving surface. Control valves are a more difficult application than open / close valves due to: the high cycle nature of the valves, the affect of stem drag on valve response and in many cases the low amount of force available to move the stem. This section will present a brief overview of a 'typical' Darlington NGD packing configuration.

The basic principle of packing is to have a material in the stuffing box (reference Figure 1) that can be pressed against the valve stem to provide a seal but not have high friction. Apart from a few valves packed with Teflon, our typical configuration is a packing set that is a combination of die-formed graphite rings, composite graphite rings and high density graphite bushings. The composite graphite rings are to minimize extrusion of the die-formed graphite material through the top and bottom of the stuffing box. High density graphite bushings are used to further aid in containing the packing set and assist in stem guiding. The bottom of most stuffing boxes is an unknown quantity so a junk ring (generally called a guide bushing in control valves) is installed to provide a solid foundation for the packing set and to guide the valve stem.

The packing material must be pressed against the stem. If it was loose there would be no seal. The sealing force is provided by a gland follower which has a force applied to it by a packing flange. The packing flange has a load applied it in one of two ways: Packing nuts bearing directly on the packing flange which are torqued down to a specific value or the packing nuts compressing a spring pack (refer-

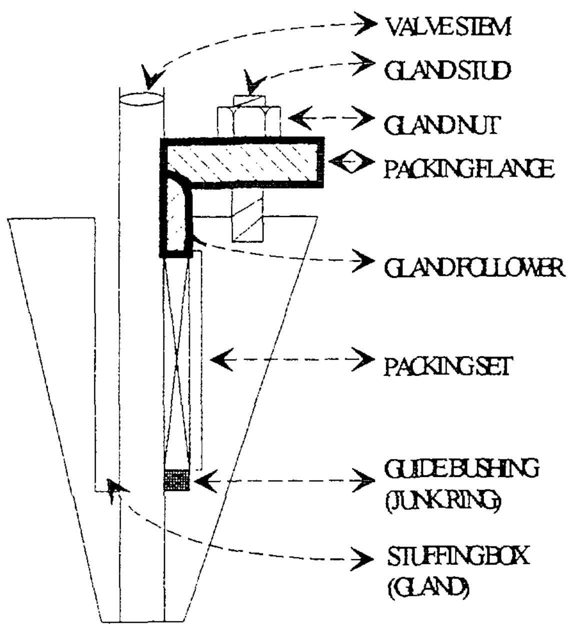

Figure 1 - Valve Packing Component Description

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DNGD Packing Program Coordinator
Maintenance Support

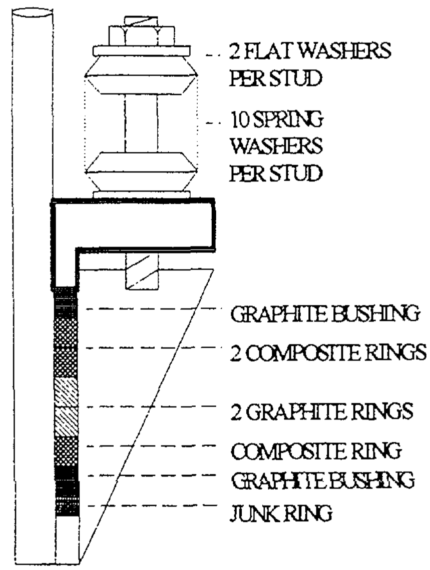

Figure 2 - Live-loaded Packing Configuration

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DNGD Packing Program Coordinator
Maintenance Support

ence Figures 1 and 2). There is no difference in applied load between these two configurations. The gland follower does not care how the load is applied to it. This is important as there seems to be a widely held belief that live-loaded packing generates higher friction. The error may come from the fact that live-loaded packing does a much better job of maintaining the applied load whereas non live loaded packing consolidates and the load decreases.

Important Points: The packing must have some value of friction in order to seal.

Live-loaded packing does not have a higher initial designed friction.

2.0 FRICTION IN CONTROL VALVES

In the ideal world a control valve would have zero friction which would allow for a smaller actuator, eliminate hysteresis from packing, facilitate easier set up and longer life. Unfortunately this world doesn't exist, thus there is a need to discuss valve friction.

As we all know there are many different types of control valves. This section describes some the potential areas of friction in the entire assembly.

Piston Actuator Either from the piston seal or any taper in the cylinder.

Actuator seal: In an air-to-open actuator the bottom of the actuator must be sealed to prevent air loss (this applies to both piston and spring-diaphragm actuators).

Actuator Spring: If the actuator stem contacts the spring or if the spring contacts the housing will there be an increase in friction.

Packing: Includes all the components of the packing set.

Stem Guiding: Guide bushing (junk ring) and gland follower if there is contact with the stem.

Plug / Cage: There will be contact between the plug and cage and / or the friction from seals in the plug / cage assembly.

All these areas can contribute to valve friction, some more than others. Some examples: We have some piston actuated valves where the actuator piston alone has a friction value of 200 lbs out of a total valve friction of 1,000 lbs. In other valves contact between the stem and the guide bushing has generated 800 lbs of static friction in a valve that had 300 lbs of dynamic friction.

Important Point: Not all friction in a valve assembly is packing friction.

3.0 VALVE PROGRAM

In order to have control valves that are repacked and setup properly a coordinated approach between valve packing and control valve programs is needed. The next three sections of this paper present the methods that are used at Darlington NGD to maintain proper setup of control valves.

The essential elements of the program are:

- Communication
- Valve Packing Program
- Valve Diagnostics

Each of these sections will be discussed in more detail below.

3.1 Communication

In any large organization there will be many groups involved in maintenance. While this cannot be avoided, good communication can assist in ensuring work is performed as required. The areas of communication that have proved successful for the repacking and set-up of control valves are:

Between the Packing Coordinator and the Valve Diagnostics Coordinator.

After determining which control valves require repacking (based on leaks, potential for future leaks, operability problems or configuration change) the Packing Coordinator generates a list. This list is reviewed by the Valve Diagnostics Coordinator to determine which are important enough to require diagnostics. This review is a must to ensure that valves that require diagnostics due to their criticality to plant operation, history of previous problems or new packing configurations have the diagnostics performed.

At times the valve diagnostics results will determine that a valve requires repacking due to a low friction value or condition of the packing area. This information is be passed on to the Packing Coordinator by the Valve Diagnostics Coordinator for entry into the program.

At Darlington NGD this communication works well as the two coordinators work in the same group and are physically located close to each other.

Between Mechanical Maintenance and the Valve Diagnostics Crew. When the Diagnostics crew prepare for work on a valve they ensure that Mechanical Maintenance will have someone ready on short notice to adjust the packing if required. This is especially important during outages where time is at a premium.

Between the Valve Diagnostic Crew and Technical Support. If a problem is noted and operability is a concern, there needs to be support for the Valve Diagnostics and Valve Packing Crews. To cover this, we ensure the Valve Diagnostics Coordinator and the Packing Coordinator are available to address problems that may arise. These two coordinators know the appropriate system engineers to contact or have the knowledge to make a reasonable decision. This is especially true during shutdowns and pagers are used to ensure minimal time is lost.

3.2 Valve Packing Program

Darlington has a well established and controlled valve packing program. This program is run by an engineer in the Maintenance Support Unit. Control valves form only a part of this program but the success of the control valve work depends on the Valve Packing Program. There are two main outputs from the Valve Packing Program used in the control valve work. The first output is the determination of a packing configurations that will not leak and will not add any unnecessary friction to the valves. The second output is the Valve Packing Technical Sheet (see Appendix A). This information is available from a Valve Packing data base on a Local Area Network (LAN) to all station staff.

The important piece of information on this data sheet for control valves is the expected valve packing friction. The number here is calculated from information provided by the packing supplier. The database is kept up to date so any changes in packing configuration will have new friction numbers calculated and presented. This means that the Valve Diagnostics Crew has access to this information easily. There is no searching through design information for data that may be out-of-date. Before diagnostics is performed, a crew member can print out a copy of the Valve Packing Technical Sheet.

The Valve Packing data base lists when the valve was last repacked. This information is useful for determining chronic leakers (frequent repacking) or valves that still have old packing configurations.

Important Point: A valve packing data base can provide up-to-date and accurate
information to the valve diagnostics crew.

3.3 Valve Diagnostics

3.3.1 General

The next step in the process is the use of valve diagnostics to ensure the operability of the valve has been maintained after the rework. The diagnostics is used to ensure that all parameters of the valve setup are correct. A numeric value for friction is only one of the many values that is determined by the diagnostics equipment, however the following discussion is related to the friction value only.

The diagnostics friction value is not just packing friction, it represents the overall valve friction. All the items that were mentioned in Section 2.0 are applicable so the friction value cannot be directly related to the packing friction value on the data sheet. In order to determine an acceptable level of friction the Valve Diagnostics Crew has been supplied with a guideline (see Appendix B). This chart details actions regarding the friction value noted from the valve diagnostic trace. The acceptable levels of 20% under and 50% over the packing friction number on the Valve Packing Technical Sheet are from station experience and they are guidelines only. If the friction value is out of specification then either a packing adjustments is made or an 'operability' check is made. This includes consultation with Technical Support and the Valve Packing Coordinator.

Important Point: The valve diagnostics friction information is only a guide to the valve's performance. In addition to the friction information there is a need for guidelines to what is 'acceptable' friction.

3.3.2 Packing Adjustments

The valve packing program has developed a procedure that allows Mechanical Maintenance to retorque packing if it is leaking. This applies to manual and motor operated valves as well as control valves. The intent of the program was to allow Mechanical Maintenance to retorque packing to values specified in the database. When control valves are repacked the torque values used are from the database (see Appendix A, page 2), the friction values from the diagnostics are not used to set the packing load. The reasons for this are:

The diagnostic friction value is not packing friction alone. Assuming that it is can lead to errors especially in valves that have high friction from other sources. For example: reducing the packing torque on a valve with high friction may cause a leak if the friction is from a sticky actuator.

The amount of load on the packing based on the Valve Packing Data Sheet and this number must be repeatable to Mechanical Maintenance. If the packing load was set using the friction values from the diagnostics then each valve would have individual torque or spring pack compression values. This value would have to be recorded on the data sheet and updated every time a valve leak was noted and torque adjustments made. It has been decided that this is not a good use of resources.

Important Point: The packing must be adjusted to suit the Valve Packing Data Sheet, not to suit the friction value from the diagnostics. The diagnostics are used to ensure the specified valve packing torque falls into a predefined friction range.

3.3.3 Operability

This concept was mentioned earlier and it is include in the packing flowchart (Appendix B). If the valve friction is outside of the range in the sheet (typically the problem will be with higher friction) the valve's 'operability' is determined. This process depends on the type of valve and valve function. Listed below are

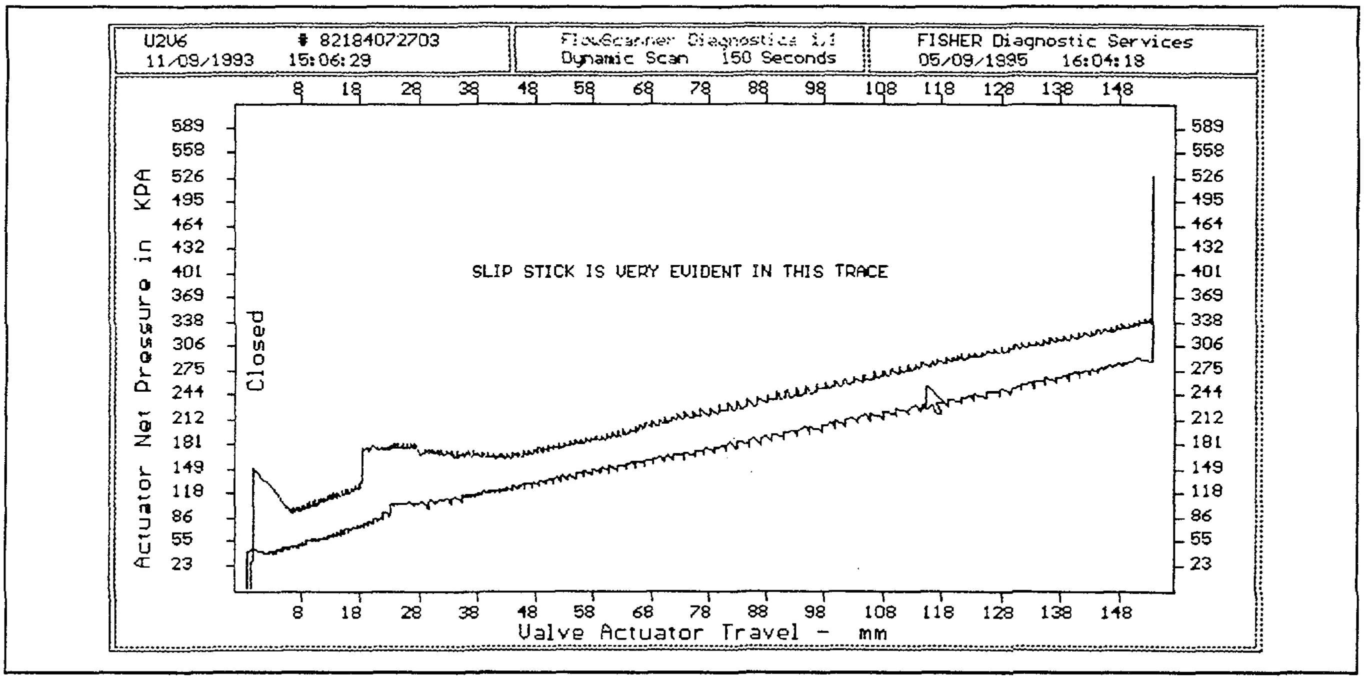


Figure 3

some hints from operational experience that may be useful when investigating the friction value for control valves:

The important considerations in determining operability are: the criticality of the valve to station operation and the parameter being controlled. If high friction is noted in feedwater valves it will probably affect the control circuit. With both the criticality of feedwater and the difficulty in controlling flow the high friction has to be investigated. In another application (i.e. level control in a drains tank) poorer control may not be a concern. The system is not a critical and level control typically is not sensitive to control valve problems. Therefore a valve with higher friction (and its associated control problems) can be tolerated and no adjustments are required.

Experience has shown that piston actuators have higher friction than spring-diaphragm valves (a 200 in^2 piston actuator may have a 200 lb friction whereas a 160 in^2 spring diaphragm will be in the 70 lb range). Therefore, piston actuators may show a higher friction value as seen on a diagnostics trace.

The phenomena of stick-slip (or "stiction") shows up on many traces. It is important to quantify the amount of slip-stick. In the Figure 3 shown below, the valve overall trace shows stick-slip through most of the valve travel and it appears to be of concern.

Figure 4 is a zoom of the trace in the 50% travel area. Note that the valve "sticks" for 1.4 psi which translates to 225 lbs of force required (this actuator is capable of producing thousands of pounds of force). When the valve does move ('slip") the amount is 0.075". In many applications this is quite tolerable so corrective actions to eliminate the stick-slip do not have to be made.

Important Point: A high friction value may not mean that there is a problem with the valve. Stick-slip may be tolerated.

3.3.4 Feedback to Database

Once the Valve Diagnostics Crew has completed their fieldwork the diagnostics information is analyzed and a report issued. One of the areas in this report is recording the 'as left' friction value. This number is sent to the Valve Packing Coordinator and is entered into the database (reference Appendix A, page 1, lower right part of sheet). This provides an indication of valve friction when performing diagnostics in the future.

Important Point: The friction value is the valve friction, not the packing and is to be used a reference only.

3.3.5 Static Scans

When performing the diagnostics one has to ensure the proper testing is performed. This section details some experience in determining if friction is affecting valve response. The diagnostic equipment is typically used for dynamic and static scans. The static scan shows the valve response to 4 ma changes in the valves input signal. Experience has shown that the 4 ma step is too large and some valve problems are

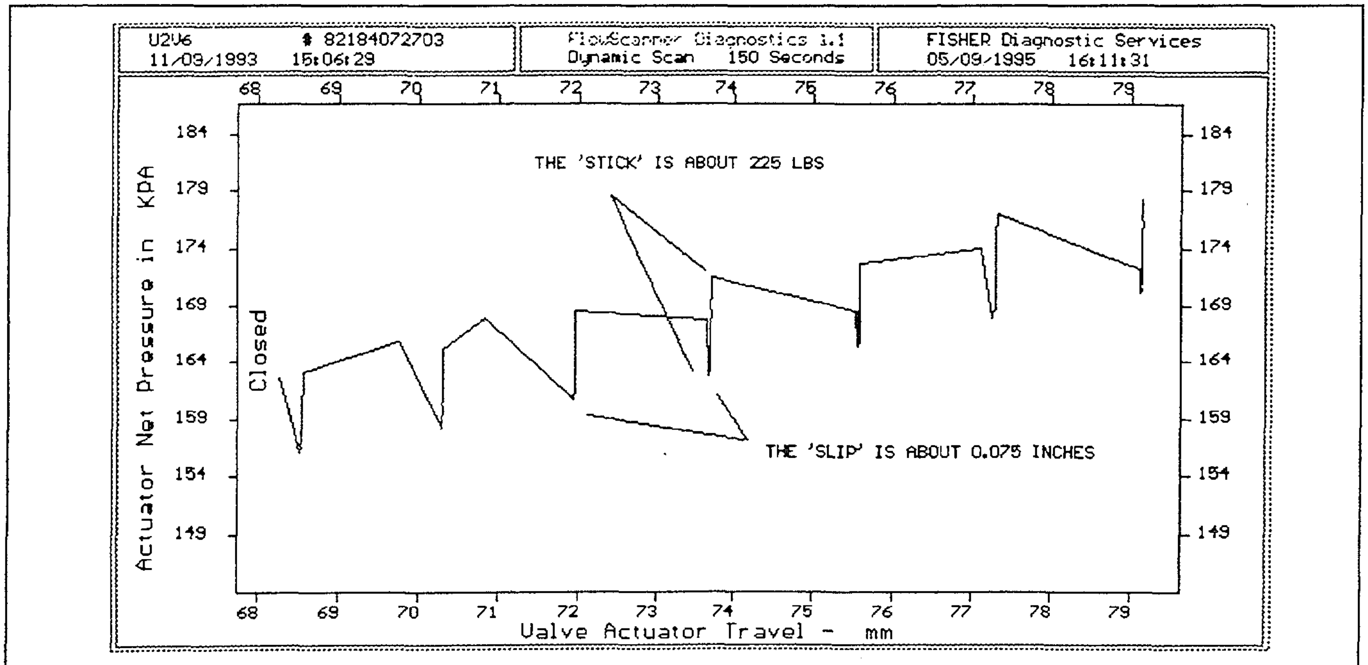


Figure 4

masked. In Figure 5 the static scan of a valve is shown. There are no problems noted in the valve response.

If a static scan with the following current steps is used (11.9 - 12.0 - 12.1 - 12.3 - 12.6 - 13.1 - 14.1 and back down) the scan looks much different (see Figure 6). At the 0.1 ma steps there is no valve response. Since in many valves a 0.1 ma step is a typical control signal change the valve may have some response problems due to friction.

Important Point: Perform diagnostic tests as close to the operating condition of the valve as possible (use small current steps).

4.0 PACKING IMPROVEMENTS

This section discusses some of the improvements to valve packing made at Darlington NGD. These are mentioned since in many cases they improved the operability of control valves. These developments were made by the station Valve Packing Coordinator with verification by Argo Packing.

Ensuring that the valve stem has a finish of 4 rms reduces the friction considerably. This is now the standard for control valve stems. All rework now includes in-house stem polishing using the Supfina Polishing Machine.

High density graphite bushings are being used for stem guiding in place of stainless steel components. The friction of the graphite bushings is minimal so valve performance is improved. In the early days problems were encountered when changing only the packing rings from asbestos to graphite (in many cases the stainless steel bushing were left in).

The perceived problems with these early graphite packing sets having higher than expected friction were in fact due to the stem binding on the tight clearances of the gland followers and guide bushings.

On some valves the originally supplied gland followers had a tight clearance (in some instances the follower would not fit into the stuffing box). This caused two problems:

- The follower could become cocked and the torque from the gland studs would not be transferred to the packing. The packing would then not be properly loaded and it would leak or blow out .
- The stem could contact the gland follower, greatly increasing friction. A new design for the gland followers was developed in-house. The features of this new design are: a change of material to Waukesha 88; increased diametrical clearances; and improved resistance to cocking.

On some valves the guide bushing came with tolerances that are too tight. This lead to stem contact damage and higher friction. Also the material selection was a problem. Some materials like 410 stainless steel lead to galling and then poorer performance. Opening up the tolerances and changing to a non-galling Waukesha 88 eliminated these problems

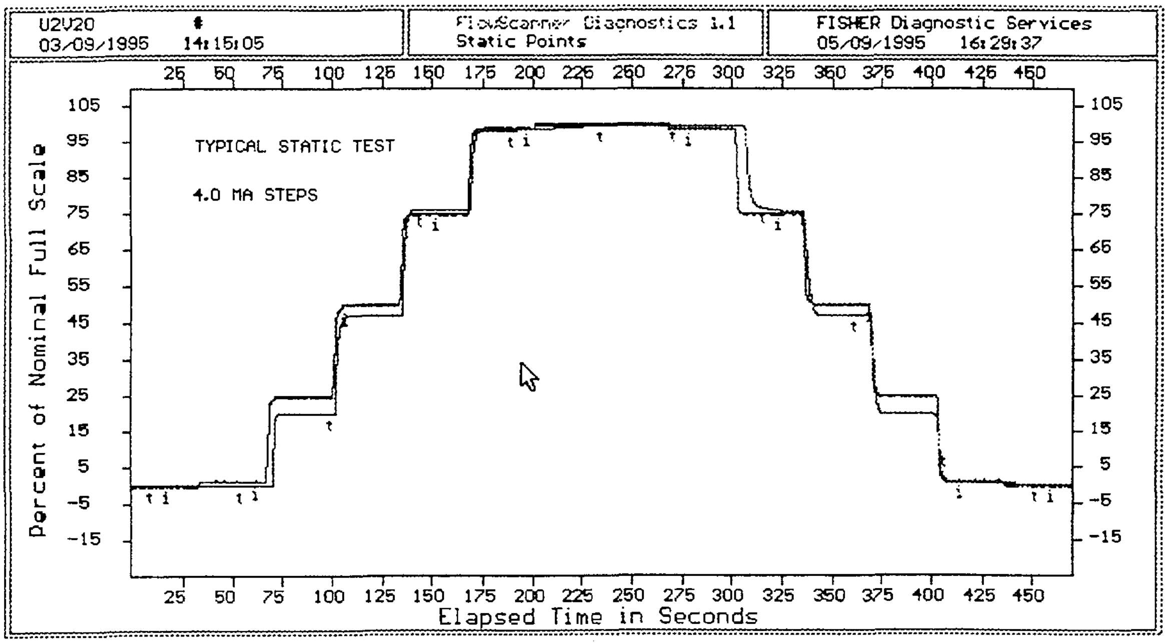


Figure 5 - **Static Scan**

5.0 SUMMARY

The following are the items required in order to get the most from your control valves with respect to packing and repacking.

Communication between all work groups involved.

A well controlled Valve Packing Program. An essential part of this program is accessible packing data with up to date packing friction numbers, gland torques, configurations and dates of installation.

Common sense in diagnostics to ensure the diagnostics is used as a guide instead of an absolute with respect to friction.

Use of small step change scans to better quantify control problems.

Control valve operability is the overriding concern for the Valve Diagnostics and Valve Packing Coordinators.

ACKNOWLEDGEMENTS

I would like to thank the following people for their contributions to putting this paper together:

Cameron Spence (Valve Packing Coordinator, Darlington NGD). Cameron has developed the Valve Packing Program at Darlington over the last four years. His input to this paper and the AOV Program has been invaluable.

Valve Crew (Darlington NGD). The many tests they have performed over the last three years has increased our knowledge level with the packing in control valves.

Appendix A: Valve Packing Database Information Sheets. Page 1: Valve Packing Technical Sheet. Page 2: Mechanical Maintenance Valve Packing Data Sheet

Appendix B: Guidelines for Determining Packing Acceptability

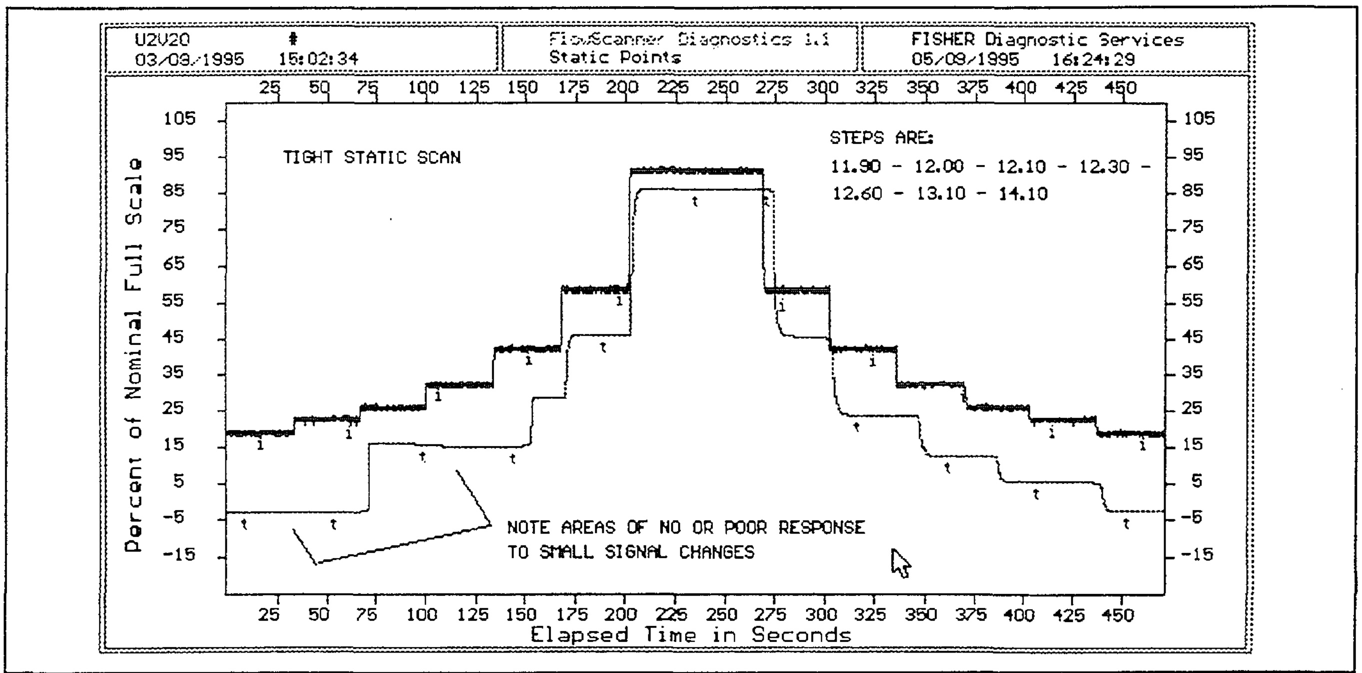


Figure 6 - **Tight Static Scan**

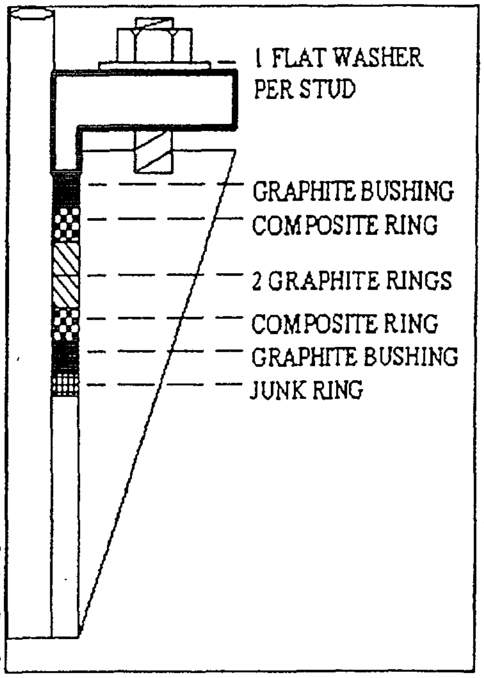
DNGD Valve Packing Program
Valve Packing Technical Sheet

GENERAL

Current Record

Unit:	4	Valve Location:	TAB 107.9 EL COL B-10		
SCI:	63617	Flowsheet/Grid:	NK38-FEX-43000-4502-D3	Nuclear (Y/N):	N
Valve #:	LCV103	Rev #:	4	Scaffold (Y/N):	N
Last Update:	1995-03-04	Safety Related (Y/N):	N	Field Checked (Y/N):	Y

Dwg Fig: V339



VALVE INFO

Valve SCN:	543F7190
Make:	COPES-VULCAN
Model:	CV600
Size:	10 in
Class:	600
Type:	GLOBE
Orientation:	VERTICAL
Oper Make:	COPES-VULCAN
Oper Model:	CV600-16R
Hand Wheel Dia:	18.0 in
Stem Thr Pitch:	thds/in
Bellow Seal (Y/N):	N

DRAWING INFO

OH #1:	63617-0006
#2:	63617-5017
#3:	NK38-D1H-60463-9050
#4:	N/A
Mfg #1:	N/A
#2:	N/A
#3:	E-263391
#4:	N/A

Valve Ser #:
Oper Ser #:
Stem Material:
CRN #:

Packing Supplier Info

Supplier:	ARGO
Pack Set Part #:	2-59-101
Up Gr Bush Part #	2-5010-05625
Lr Gr Bush Part #	2-5010-05625
Gr Lantern Ring Part #:	N/A
Spring Part #:	N/A
# Springs/Stud:	N/A
Flat Washer Part #:	6F177
# Flat Washers/Stud:	1

TECHNICAL INFO

Mtce Manual:	M-NK38-60463-9190
OH Req #:	NK38-RH-60463-03

Packing Stress

Preferred:	4000 psi
Minimum:	3000 psi
Left As:	3795 psi

Gland Load

Preferred:	3140 lbs
Minimum:	2355 lbs
Left As:	2979 lbs
Pref Per Stud:	1570 lbs
MIN Per Stud:	1178 lbs
Left As/Stud:	1490 lbs

Packing Friction

Packing Height:	1.000 in
Friction Coeff:	0.05
Transfer Ratio:	0.85
Live Load Factor:	0.75
Calc (Pref):	707 lbs
(MIN):	530 lbs
(Left As):	671 lbs
Est (ARGO):	300 lbs
OEM Value:	630 lbs
(A) As Left:	420 lbs
(B) Empty Gland:	lbs
(A-B) Actual:	420 lbs
Diagnostic Date:	1993-08-21

COMMENTS/HAZARDS:

GRAPHITE BUSHING SCN IS 563C6376. FLAT WASHER SCN IS 563C4290. NEW GLAND FOLLOWER (543AAH92) AND JU NK RING (543AAJ50) ARE INSTALLED. THIS VALVE WAS R EWORKED UNDER DR 2-94-19620-01. STEM WAS POLISHED USING SURFINA. DATA SHEET NOT RETURNED.

Return completed Valve Packing Tech Sheet to Cameron Spence (x7336 Mtce Support)

Produced: Monday, May 29, 1995 DA2 - B3

DNGD Valve Packing Program
Mech Mtce Valve Packing Data Sheet

GENERAL

Current Record

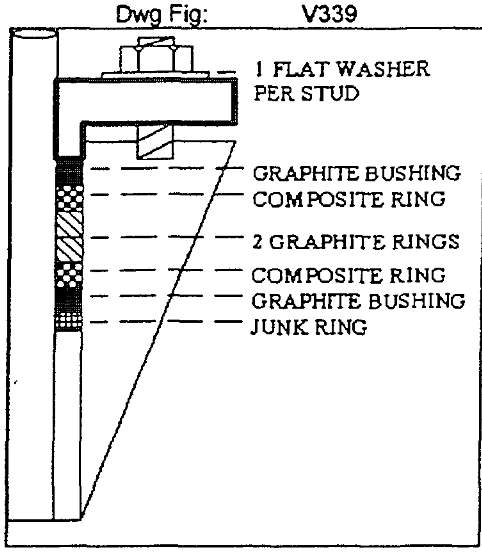
Unit:	4	Valve Location:	TAB 107.9 EL COL B-10
SCI:	63617	Flowsheet/Grid:	NK38-FEX-43000-4502-D3
Valve #:	LCV103	Rev #:	4
Last Update:	1995-03-04	Safety Related (Y/N):	N

Nuclear (Y/N):	N
Scaffold (Y/N):	N
Field Checked (Y/N):	Y

VALVE INFO

Valve SCN:	543F7190
Make:	COPES-VULCAN
Model:	CV600
Size:	10 in
Class:	600
Type:	GLOBE
Orientation:	VERTICAL
Oper Make:	COPES-VULCAN
Oper Model:	CV600-16R
Hand Wheel Dia:	18.0 in
Stem Thr Pitch:	Thds/in
Bellow Seal (Y/N):	N

Dwg Fig: V339



NOTE: If there is a "JUNK" Ring Present Re-Install Ring with NEW Packing

PACKING INFO

Packing Set SCN:	563C6334
Type:	COMPOSITE
Material:	GRAPHITE

Gland Torque

Preferred:	117 IN lbs
Minimum:	88 IN lbs
Left As:	111 IN lbs
Stem Diameter:	0.750 in
Gland Diameter:	1.250 in
Gland Depth:	2.625 in
Stud Diameter:	0.375 in
# of Studs:	2
Stud Nut Size:	11/16 in
Stud Nut Height:	0.365 in
Gland Flange Ht:	1.000 in
Gland Fol Step Ht:	0.187 in
Gland Fol Insert Ht:	0.875 in
Gland Fol Insert OD:	1.242 in
Up. Gr. Bushing Ht:	0.5625 in
Lr. Gr. Bushing Ht:	0.5625 in
Junk Ring Ht:	0.250 in
Last Packed:	1995-01-30
Times Packed:	2
Times Stem Repaired:	0

LIVE LOADING INFO

Live Load (Y/N):	N
Bel. Washer SCN:	N/A
Stud Type:	STRAIGHT
Stud Material:	GR B7
Total Stud Lgth:	3.000 in
Effective Stud Lgth:	2.500 in
Radial Stud Clear:	0.625 in
Axial Stud Clear:	1.625 in
Eye Bolt Inner Dia:	N/A in
Eye Bolt Thickness:	N/A in

GASKET INFO

Gasket SCN:	543G9451
Type:	SPIRAL WOUND
Material:	GRAPHITE
Bonnet Torque:	375/1 FT lbs
Bonnet Nut Size:	1-5/8 in
Bonnet Stud Size:	in
Gasket Date:	
Times Gskt Repaired:	0

Leakoff Port Info

Port Type:	UNKNOWN
Active (Y/N):	N
Inner Diameter:	N/A in
Port Depth:	N/A in
Lantern Ring Ht:	N/A in

COMMENTS/HAZARDS:

GRAPHITE BUSHING SCN IS 563C6376. FLAT WASHER SCN IS 563C42 90. NEW GLAND FOLLOWER (543AAH92) AND JUNK RING (543AAJ50) A RE INSTALLED. THIS VALVE WAS REWORKED UNDER DR 2-94-19620-01 . STEM WAS POLISHED USING SUPFINA. DATA SHEET NOT RETURNED.

Valve Cycled 5 Times (Y/N):	
Torqued Left As:	lbs
Date Packed:	
Packed By:	

Tolerances Allowed: Stem Dia - 0.010" Gland Dia + 0.020"

Return completed Valve Packing Data Sheet to: Cameron Spence (x7336 Mtce Support)

Produced: Monday, May 29, 1995 **DA2 - B3**

Valve Packing Adjustments for Control Valves

IN MANY INSTANCES CONTROL MAINTENANCE VALVE CREW IS REQUESTED TO FLOWSCAN CONTROL VALVES AFTER THEY ARE REPACKED TO ENSURE OPERABILITY. LISTED BELOW ARE SOME GUIDELINES FOR RELATING THE FRICTION VALVES FROM THE FLOWSCANNER AND THE INFORMATION IN VALVE DATABASE (ON THE LAN).

The information below applies to Flowscanning AOV's that have been newly repacked with composite graphite.

IN VALVE SHOP OBTAIN INFORMATION FROM VALVE DATABASE. THIS IS TO INCLUDE:

- IS THE PACKING COMPOSITE GRAPHITE? THIS CHART FOR COMPOSITE GRAPHITE ONLY.
- THE MINIMUM AND PREFERRED TORQUE VALUES FOR THE GLAND STUDS (PAGE 1 OF DATABASE)
- THE ARGO FRICTION VALUE (FROM PAGE 2 OF DATABASE).

↓

EXPERIENCE HAS SHOWN THAT COMPOSITE GRAPHITE PACKING REQUIRES CONSOLIDATION.

STROKE THE VALVE 20 TIMES BEFORE PROCEEDING.

↓

PERFORM A DYNAMIC SCAN ON THE VALVE AND DETERMINE THE OVERALL FRICTION.

IS THE FRICTION -20 / +50 % OF THE ARGO VALUE?

(NOT ALL FRICTION FROM THE FLOWSCANNER IS PACKING THEREFORE THE RANGE)

YES → ASSUME THE PACKING IS CORRECT AND REQUIRES NO REWORK, CONTINUE WITH NORMAL VALVE SET-UP

NO → IS THE FRICTION LOWER OR HIGHER THAN THE ARGO VALUE?

LOWER → A

CONTINUED ON PAGE 2

HIGHER → B

CONTINUED ON PAGE 2

Valve Packing Adjustments for Control Valves

A

OBTAIN M/M HELP FOR ADJUSTMENTS TO PACKING.

- HAVE M/M DETERMINE THE "AS-FOUND" TORQUE. THIS VALUE IS TO BE RECORDED IN THE VALVE ANALYSIS.

* M/M NOT TO EXCEED PREFERRED TORQUE VALUE ON DATASHEET

- INCREASE THE TORQUE SLOWLY. AS A GUIDELINE INCREASE TORQUE IN 1 FT-LB OR 5 IN-LB STEPS (UNITS DEPEND ON INFO FROM VALVE DATASHEET).
- PERFORM DYNAMIC AND STATIC* SCAN AFTER EACH INCREASE IN TORQUE. THE OBJECTIVE IS TO REACH THE PREFERRED TORQUE WITHOUT AFFECTING OPERABILITY.

BASED ON DYNAMIC AND STATIC SCANS* ARE THERE PROBLEMS WITH THE VALVE OPERABILITY?

NO → ONCE PREFERRED TORQUE IS REACHED AND VALVE IS OPERABLE THEN NO FURTHER WORK REQUIRED. ENSURE FRICTION IS REPORTED IN ANALYSIS.

YES → (back off torque, below)

B

BASED ON DYNAMIC AND STATIC SCANS* ARE THERE PROBLEMS WITH THE VALVE OPERABILITY?

NO → NO FURTHER WORK REQUIRED. ENSURE FRICTION AND OPERABILITY ARE REPORTED IN ANALYSIS.

YES → CONTACT MAINTENANCE SUPPORT:
B. SPEER - 7919 C. SPENCE - 7336
TO OBTAIN APPROVAL FOR THE NEXT STEP

- BACK OFF TORQUE IN 1FT-LB OR 5-IN-LB STEPS (UNITS DEPEND ON INFO IN VALVE DATABASE).
- PERFORM DYNAMIC AND STATIC* SCAN AFTER EACH DECREASE IN TORQUE. THE OBJECTIVE IS TO OBTAIN VALVE OPERABILITY.
- ENSURE FRICTION, OPERABILITY AND "AS-LEFT" TORQUE INFORMATION IS REPORTED IN THE VALVE ANALYSIS.

PREPARED BY:

VERIFIED BY:

* AS PER FISHER'S RECOMMENDATION FOR STATIC SCAN USE 5-8-12-16-19 (AND BACK) MA