AGENDA

NRC/JOG PUBLIC MEETING

MOTOR-OPERATED VALVE PROGRAM ON PERIODIC VERIFICATION

May 9, 2001

OWFN O-9B4

8:30 a.m.	Introductions (NRC and JOG)
8:35 a.m.	GL 96-05 Review Issues and Status (NRC)
9:00 a.m.	Status of Utility Testing and Data Submittals (JOG)
9:20 a.m.	JOG Test Program Results since previous meeting (JOG)
10:15 a.m.	BREAK
10:30 a.m.	Continue: JOG Test Program Results (JOG)
11:00 a.m.	Status of Utility Feedback Notices (JOG)
11:15 a.m.	Items of Interest (NRC) - BWROG dc motor performance methodology - MOV performance information for generic failure rate databases
11:45 a.m.	Action Items and Schedule for Next Meeting (NRC and JOG)
Noon	Closing (NRC)

STATUS OF NRC STAFF REVIEW OF LICENSEE PROGRAMS ESTABLISHED IN RESPONSE TO GENERIC LETTER 96-05 (May 9, 2001)

LICENSEES OF 98 REACTOR UNITS COMMITTED TO IMPLEMENT JOINT OWNERS GROUP PROGRAM ON MOV PERIODIC VERIFICATION IN RESPONSE TO GL 96-05, "PERIODIC VERIFICATION OF DESIGN-BASIS CAPABILITY OF SAFETY-RELATED MOTOR-OPERATED VALVES"

LICENSEES OF 5 REACTOR UNITS ARE IMPLEMENTING PLANT-SPECIFIC GL 96-05 PROGRAMS:

Callaway
Fort Calhoun
Palisades
San Onofre 2/3

NRC STAFF HAS ISSUED SAFETY EVALUATIONS CLOSING ITS GL 96-05 REVIEW FOR 98 REACTOR UNITS.

NRC STAFF IS COMPLETING GL 96-05 SAFETY EVALUATIONS FOR THE 5 OTHER OPERATING REACTOR UNITS:

Callaway	technical review complete
Cook 1/2	inspection planned for spring 2001
Davis-Besse	technical review complete
Fort Calhoun	technical review complete

Joint Owners' Group (JOG)
MOV Periodic Verification (PV) Program

Status Update

JOG-NRC Meeting

May 9, 2001

MPR

JOG PV Program Participation

- Four Owners' Groups
  - B&WOG, BWROG, CEOG & WOG
    - 62 plants
    - 98 units

- 197 Test MOVs
  - 150 Gate Valves
  - 27 Butterfly Valves
  - 8 Balanced Disk Globe Valves
  - 12 Unbalanced Disk Globe Valves
  - Current Test Matrix is attached

Testing Progress

Scorecard for Testing & Test Package Submittals (as of 3/31/01)

Test Sequence	Tests Scheduled	Tests Performed	Percent of Scheduled Tests Performed	Test Packages Due	Test Packages Submitted	Percent of Due Packages Submitted
Baseline	197	191	97%	182	177	97%
Second	153	141	92%	115	114	99%
Third	48	41	85%	28	28	100%
Total	**398**	**373**	**94%**	**325**	**319**	**98%**
October-00	**346**	**303**	**88%**	**300**	**283**	**94%**

Summary of Valves Tested vs Valves Untested

	Baseline	Second	Third	Cumulative
Tested	191	141	41	373
Untested	6	56	156	218
Percent Tested	**97%**	**72%**	**21%**	**63%**

Dynamic Test Phase Schedule

- End of testing scheduled for October 2002
- More valves in program than originally planned
- Attrition lower than expected
- Some third tests to be completed after 10/2002
  - late joining plants
  - rejected test packages
  - schedule difficulties
  - unplanned valve maintenance
- Impact of tests beyond 10/2002 evaluated -- expect to have adequate data to draw program conclusions

Key Observations

Gate Valves

- Disassembly/reassembly is the dominant influence. VFs of disassembled valves tend to be reduced and tend to increase during service.
- Valves not disassembled do not show degradation
- Exceptions
  - 3 valves show increases from low initial VFs to more "normal" values
  - 1 valve shows an increase from a high initial VF (closing only) [suspect influence of instrumentation/actuator mods; wait for 3rd test]
  - 1 valve shows an increase from a high initial VF (open and close) [following up with plant to examine similar valves]

Key Observations (cont'd)

Butterfly Valves (bearing friction)

- Non-bronze bearings and bronze bearings in clean water - no degradation
- Bronze bearings in raw water - significant variations - unclear if there is a consistent degradation trend

Balanced Disk Globe Valves

- Low valve factors and no degradation
- Observed transitory variations in thrust in raw water applications (not degradation)

Unbalanced Disk Globe Valves

- Small changes in VF, but no evidence of degradation

Feedback to Program Participants

- No new Feedback Notices since last NRC meeting (October 2000)
- Previous Feedback Notices Issued
  - **Feedback Notice FN-01, Rev.1** issued April 1999 to communicate information on an Aloyco split wedge gate valve with significant observed valve factor increase
  - **Feedback Notice FN-02, Rev.0** issued October 1999 to address potential impact of under-filled matrix categories on Program coverage
  - **Feedback Notice FN-03, Rev.0** issued February 2000 to address observed behavior of gate valves after valve disassembly

FN-03: Gate Valve Disassembly/Re-assembly

- FN-03 addresses observed behavior of gate valves after valve disassembly/re-assembly
  - VFs of disassembled valves tend to be reduced and tend to increase during service
- 44 of 139 gate valves to date were disassembled prior to JOG baseline test
- In general, disassembly attributed to pressure-locking modifications to address GL 95-07

Protocol for Data Presentation

- Previous presentations
  - mix of baseline-only and repeat tests
  - both approved and unapproved data presented
    - small amount of data available
  - some unapproved data changed during approval process
    - required re-presenting once data approved
- Current presentation
  - only approved repeat data presented
    - large amount of data now available
      - 51 repeat test packages approved since last meeting
    - less confusing to present only approved data

Dynamic Test Program Results

Test results presented focus on valves with at least one repeat test and whose data is approved

Valve Type	No. of Valves Presented with Approved Baseline & Second Test Data	No. of Valves Presented with Approved Baseline, Second & Third Test Data
Gate	61	13
Butterfly	11	--
Balanced Globe	6	2
Unbalanced Globe	5	2

Gate Valve Test Results

- General Observations for Gate Valves
  - Valve disassembly/reassembly is the dominant influence on changes in VF
  - With a few exceptions, valves not disassembled do not show degradation
  - VFs of disassembled valves tend to be reduced and tend to increase during service
  - Three valves not disassembled show low initial VFs and increase during testing. Waiting for third tests.
    - G44.03 - low DP stroking before JOG tests
    - G63.05 - never DP stroked before JOG tests (FN-01)
    - G89.03 - occasionally DP stroked, but under conditions much less than JOG tests

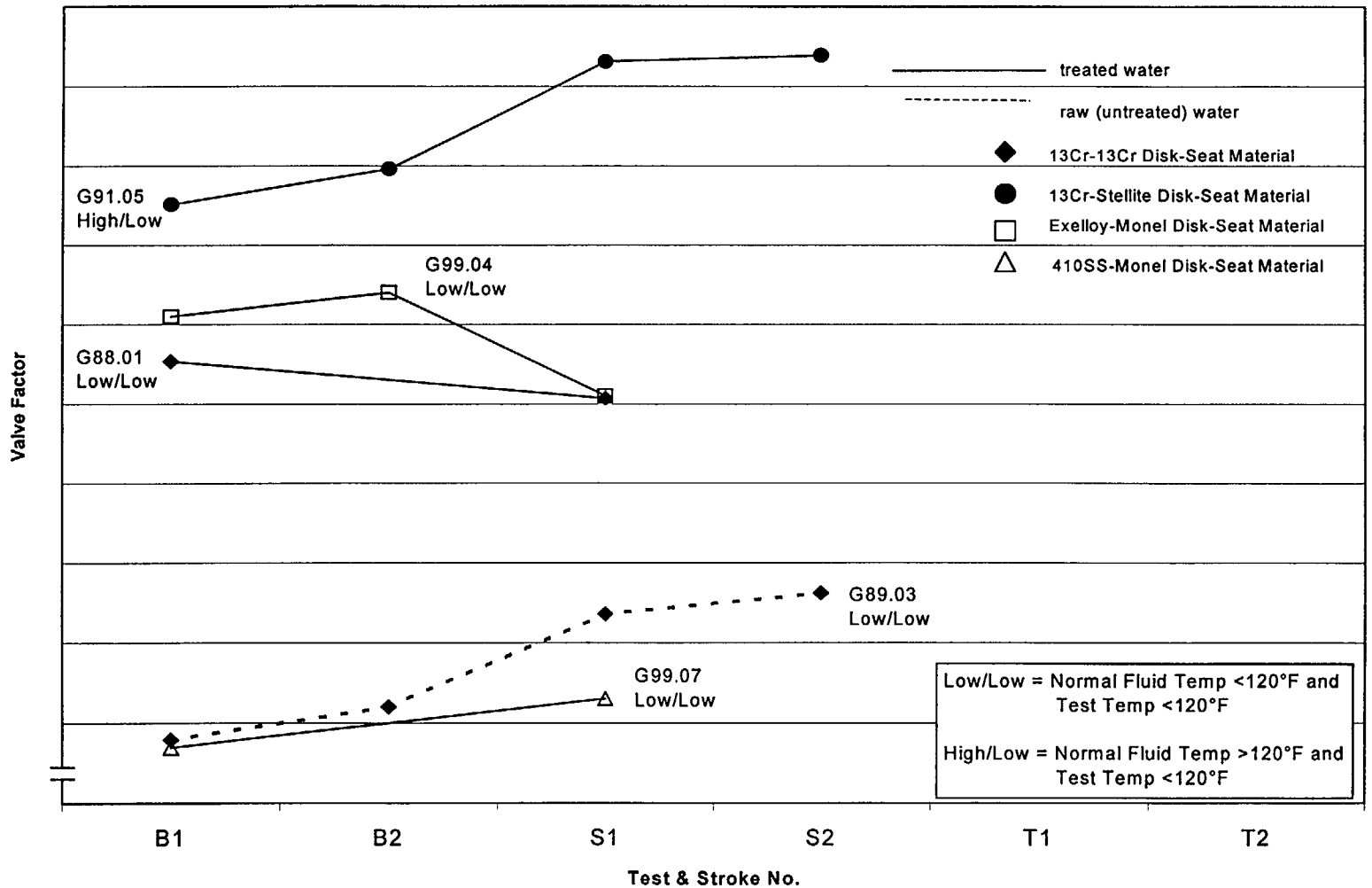
Gate Valve Test Results (cont'd)

- General Observations for Gate Valves (cont'd)
  - One valve not disassembled (G79.02) with high initial VFs shows an increase (closing only) - modification to actuator/instrumentation may have affected data. Waiting for third test.
  - One valve not disassembled (G91.05) with high initial VFs shows an increase. Further investigation of similar valves at plant is underway.
  - Guide friction affects/controls required thrust on some opening strokes.

Gate Valve Test Results (cont'd)

- Evaluation of gate valve results considers disk-to-seat friction and guide friction separately
  - Seat Friction: closing strokes from flow isolation to initial wedging; opening strokes from just after cracking to flow initiation
  - Guide Friction: closing strokes before flow isolation and opening strokes after flow initiation
- Grouping of gate valves for presentation include subdivisions by:
  - fluid medium
  - disk-to-seat material pair
  - guide material pair
  - high/low DP stroking
  - normal valve position
  - stem orientation
  - valve disassembly

Progression of Closing Valve Factors at Initial Wedging - Non-Stellite Seat Pairs



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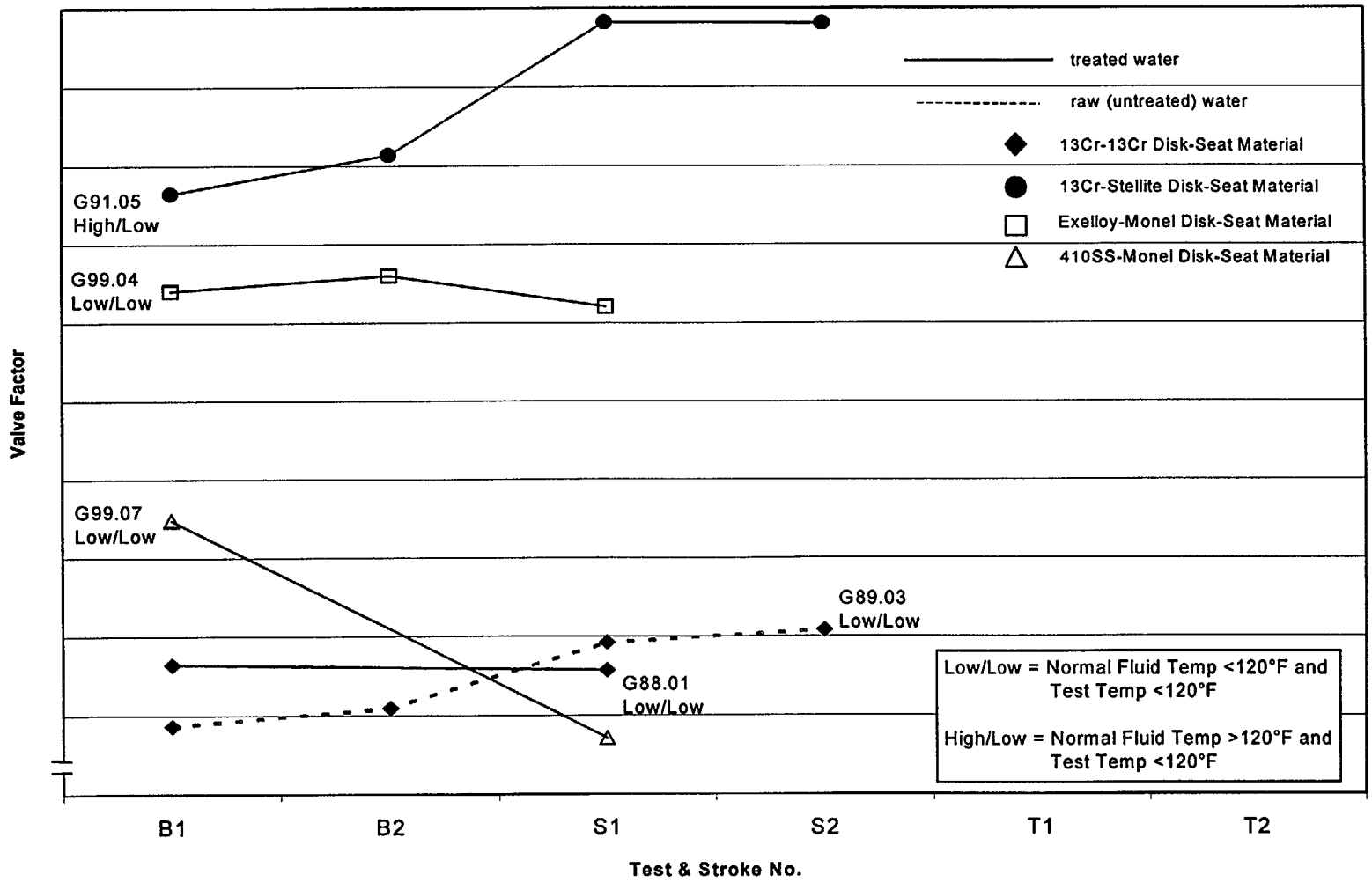
Progression of Opening Valve Factors at Flow Initiation - Non-Stellite Seat Pairs



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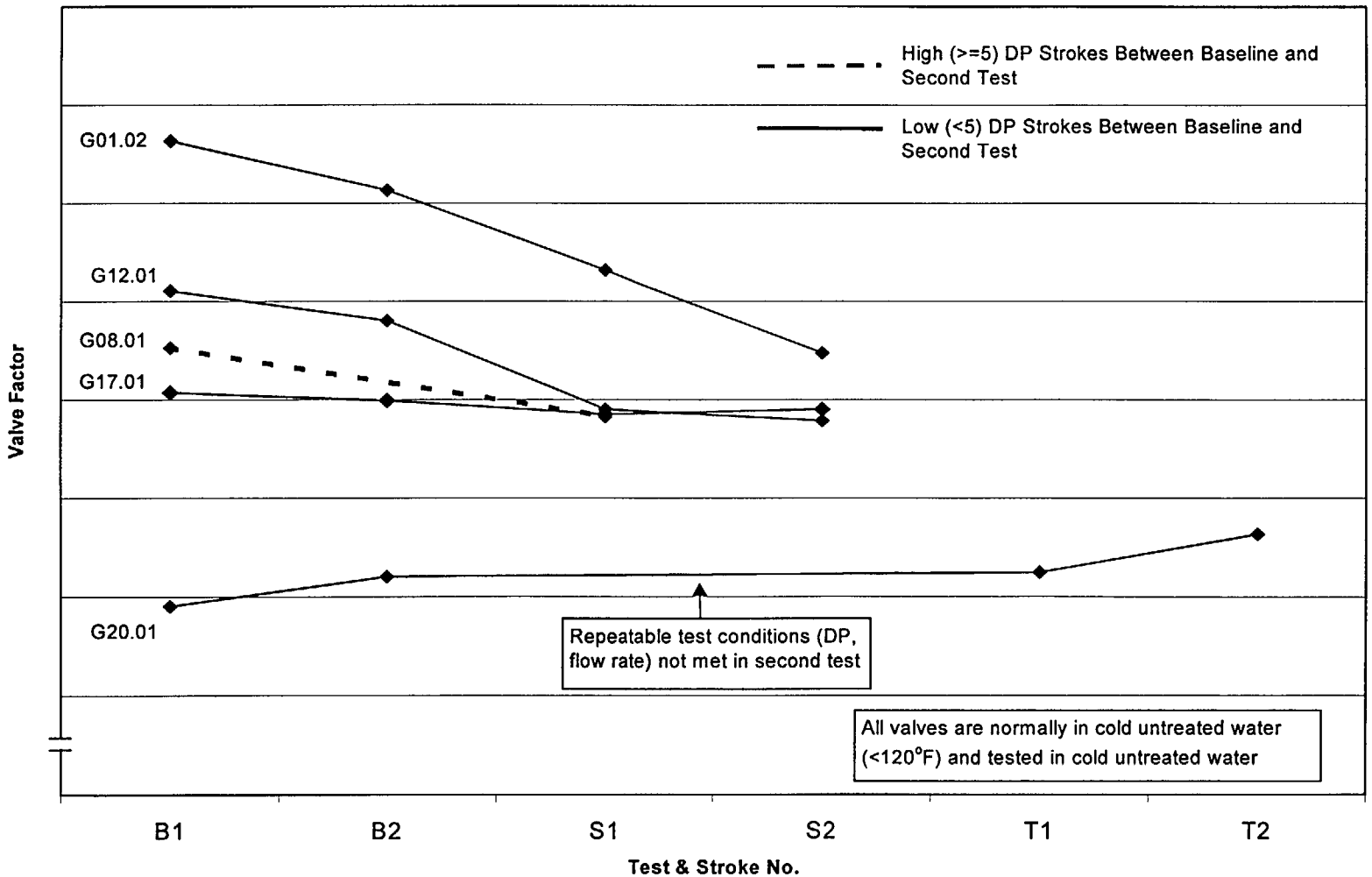
Progression of Closing Valve Factors at Initial Wedging - Stellite Seats/Untreated Water



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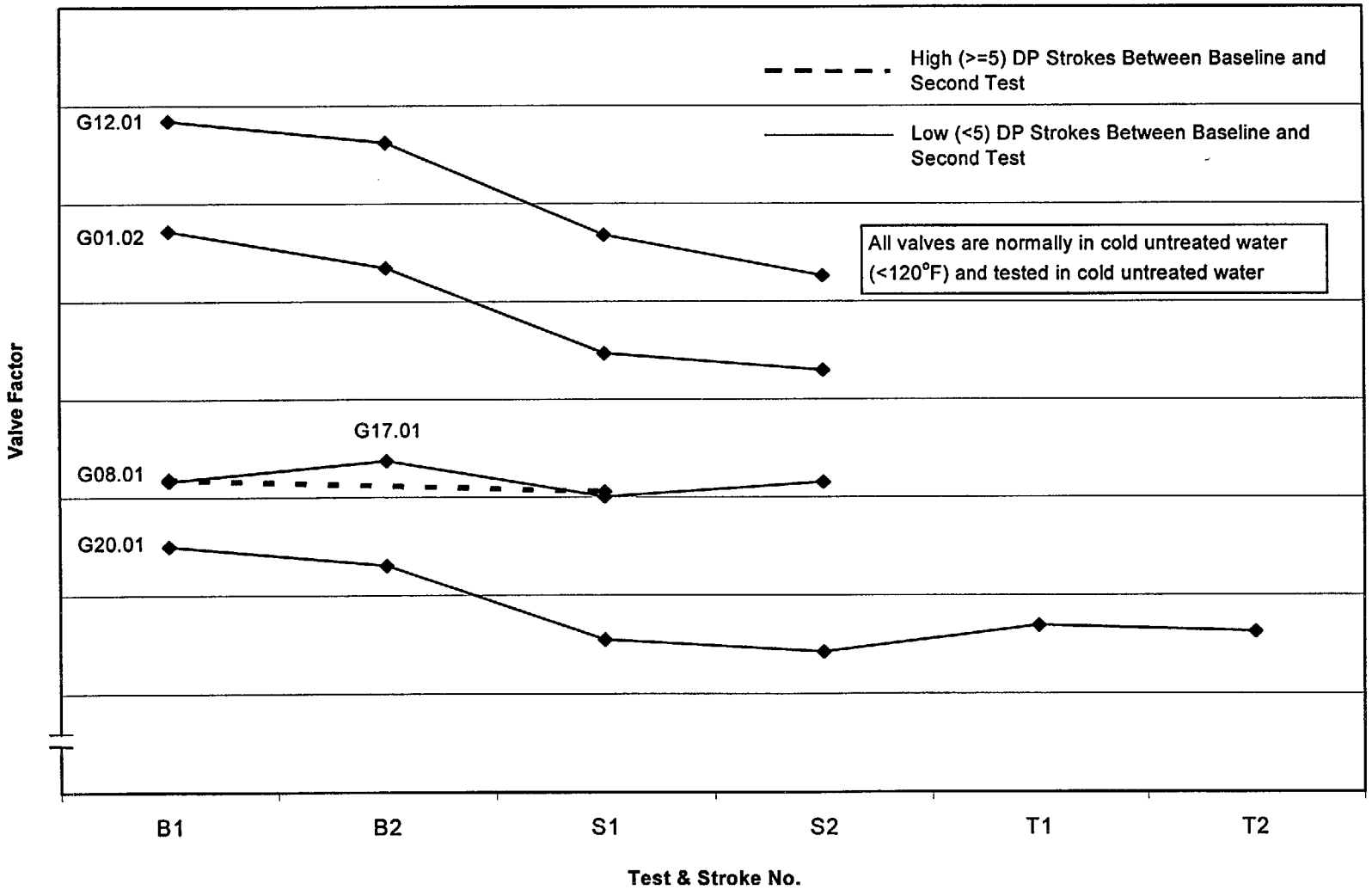

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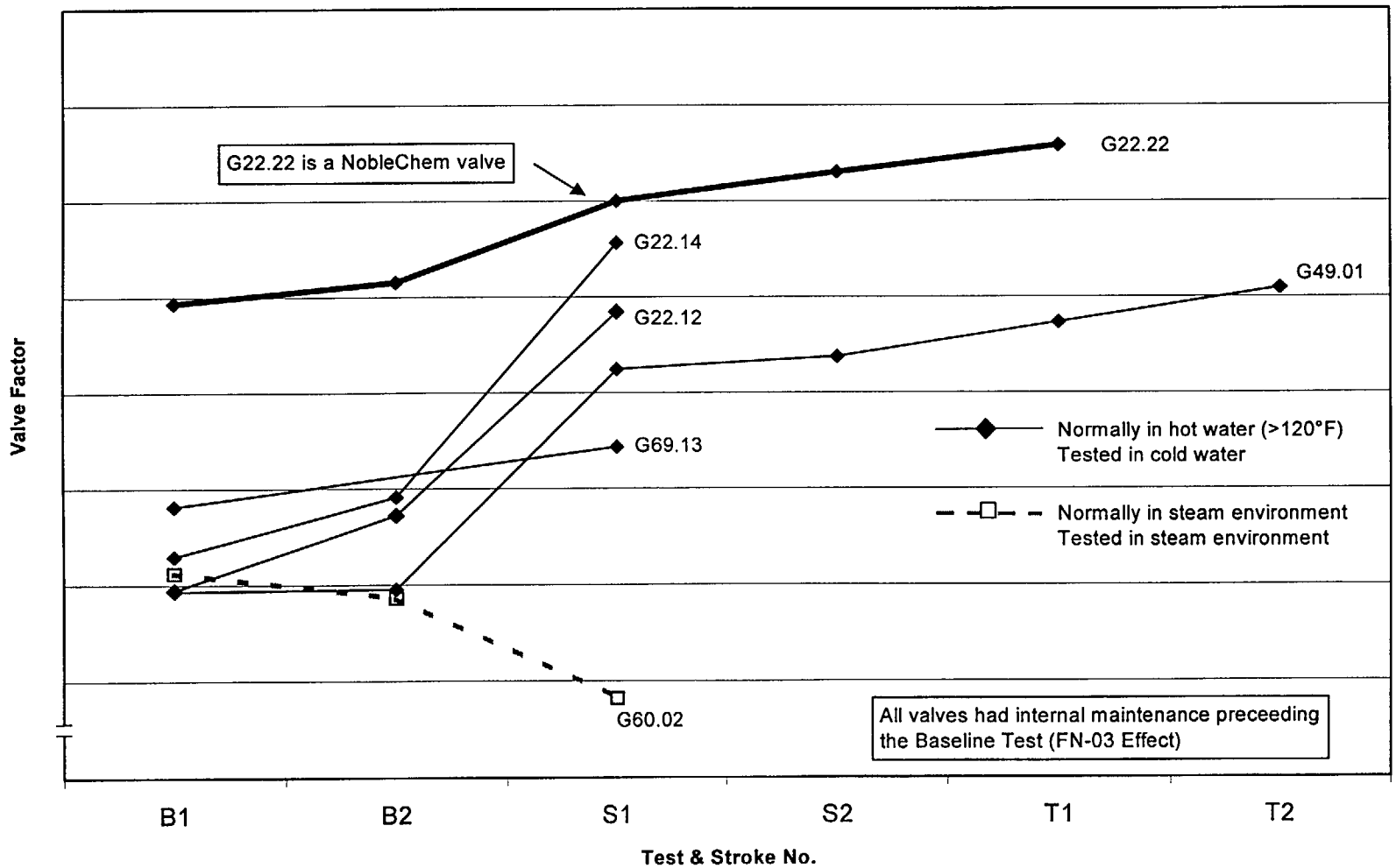
Progression of Closing Valve Factor at Initial Wedging - Stellite Seats/ Hot Water/Steam - Internal Maintenance Prior to Baseline Test (FN-03 Effect)



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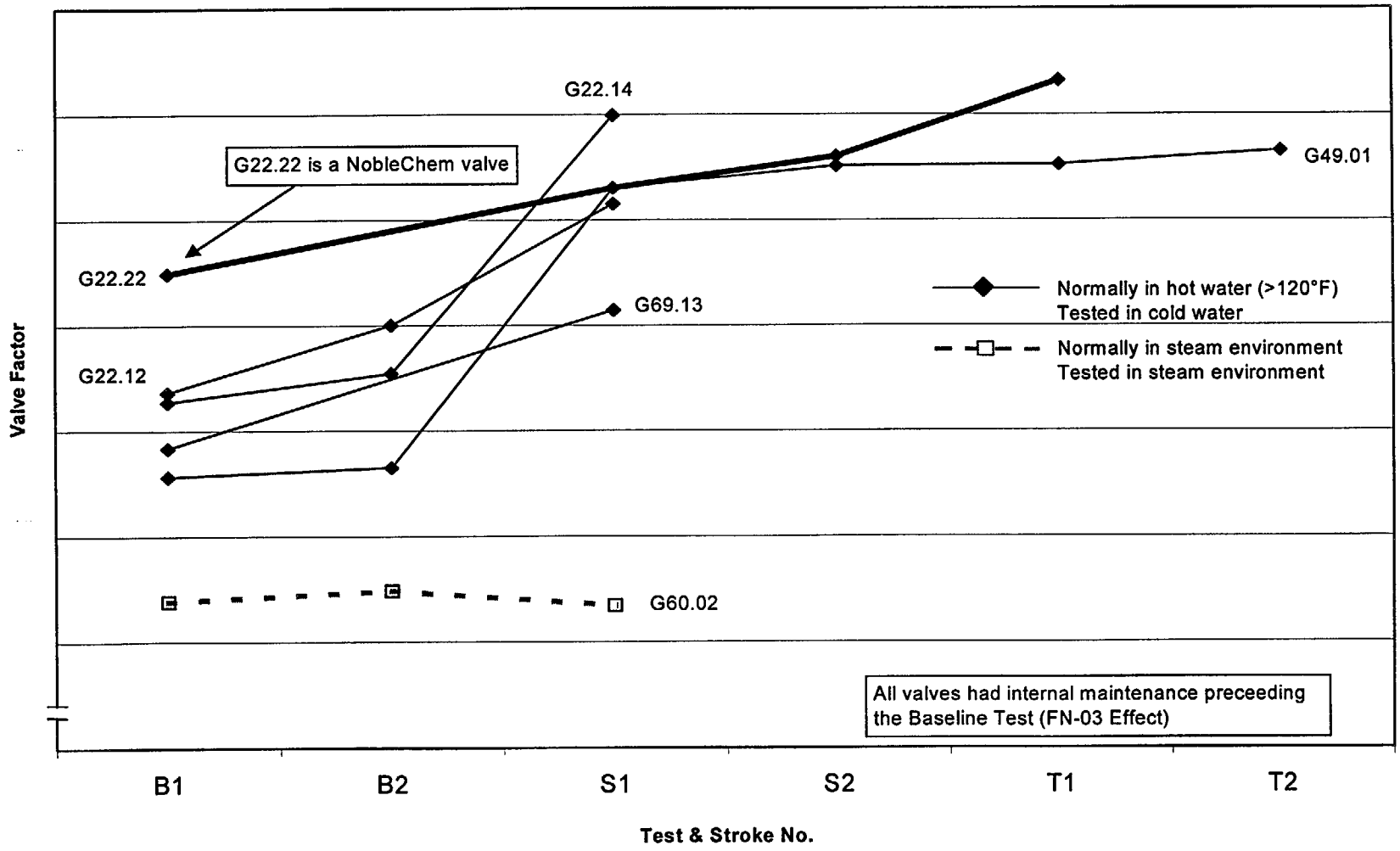

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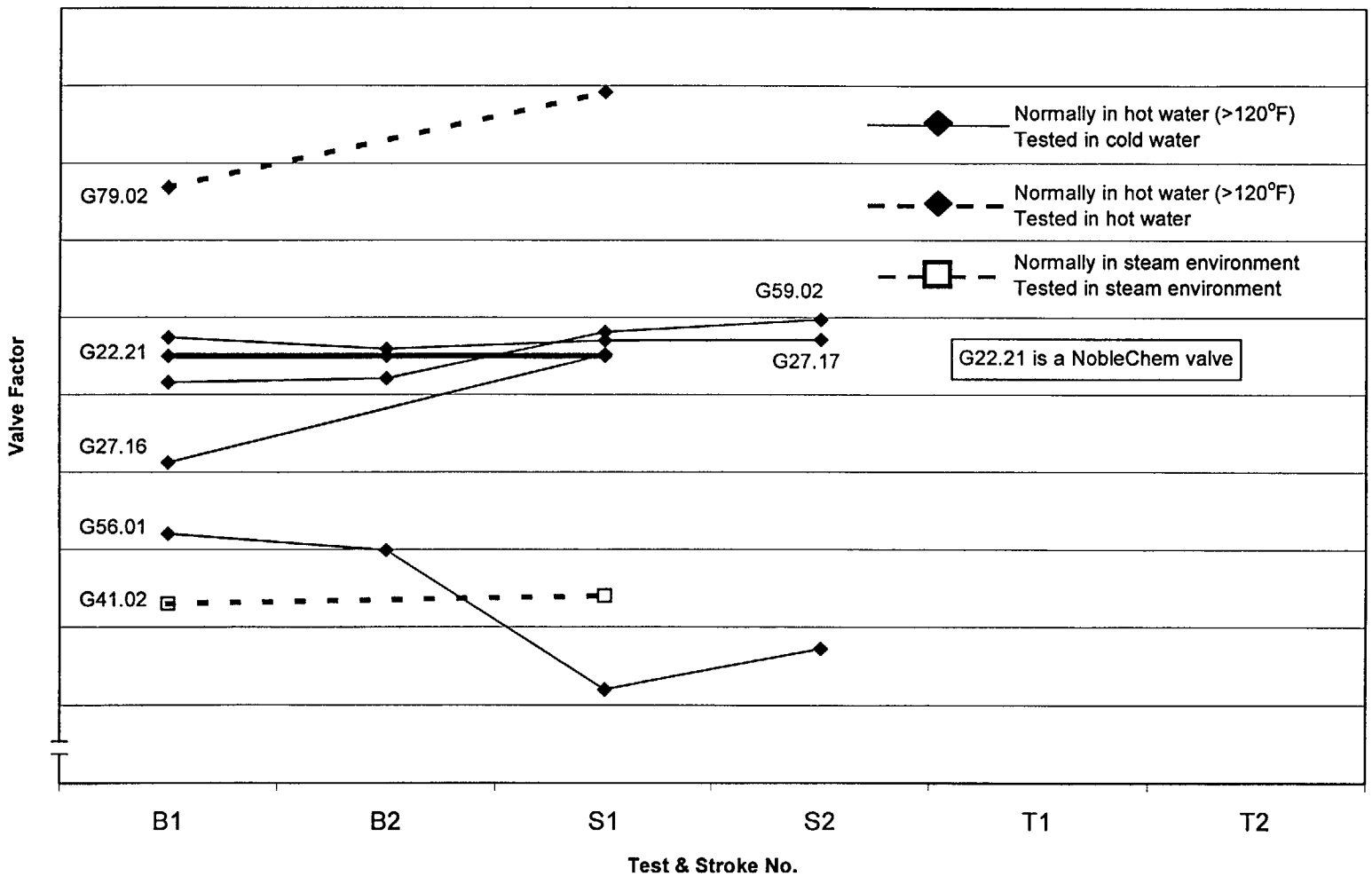
Progression of Closing Valve Factor at Initial Wedging - Stellite Seats/ Hot Water/Steam - No Internal Maintenance Prior to Baseline Test



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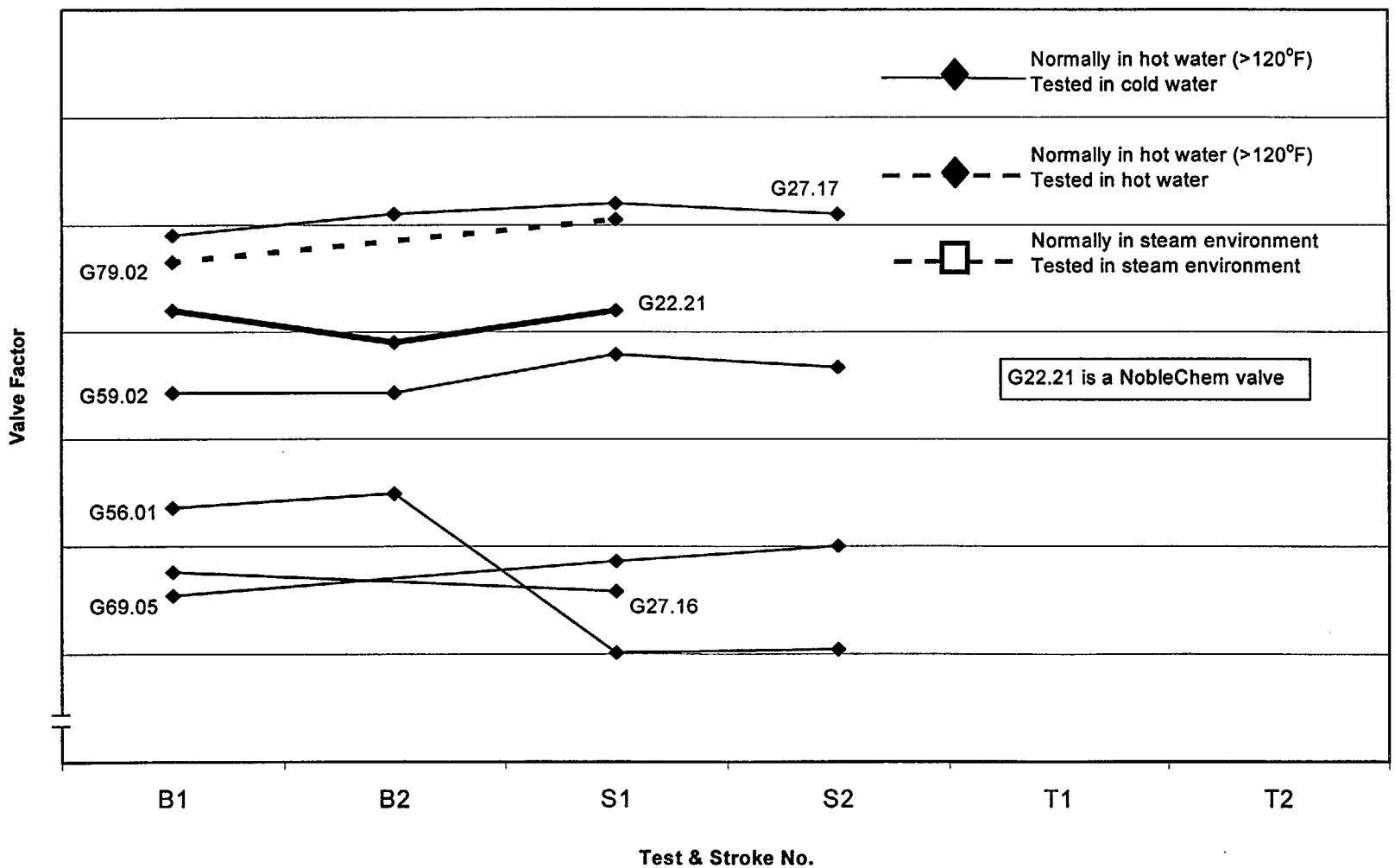

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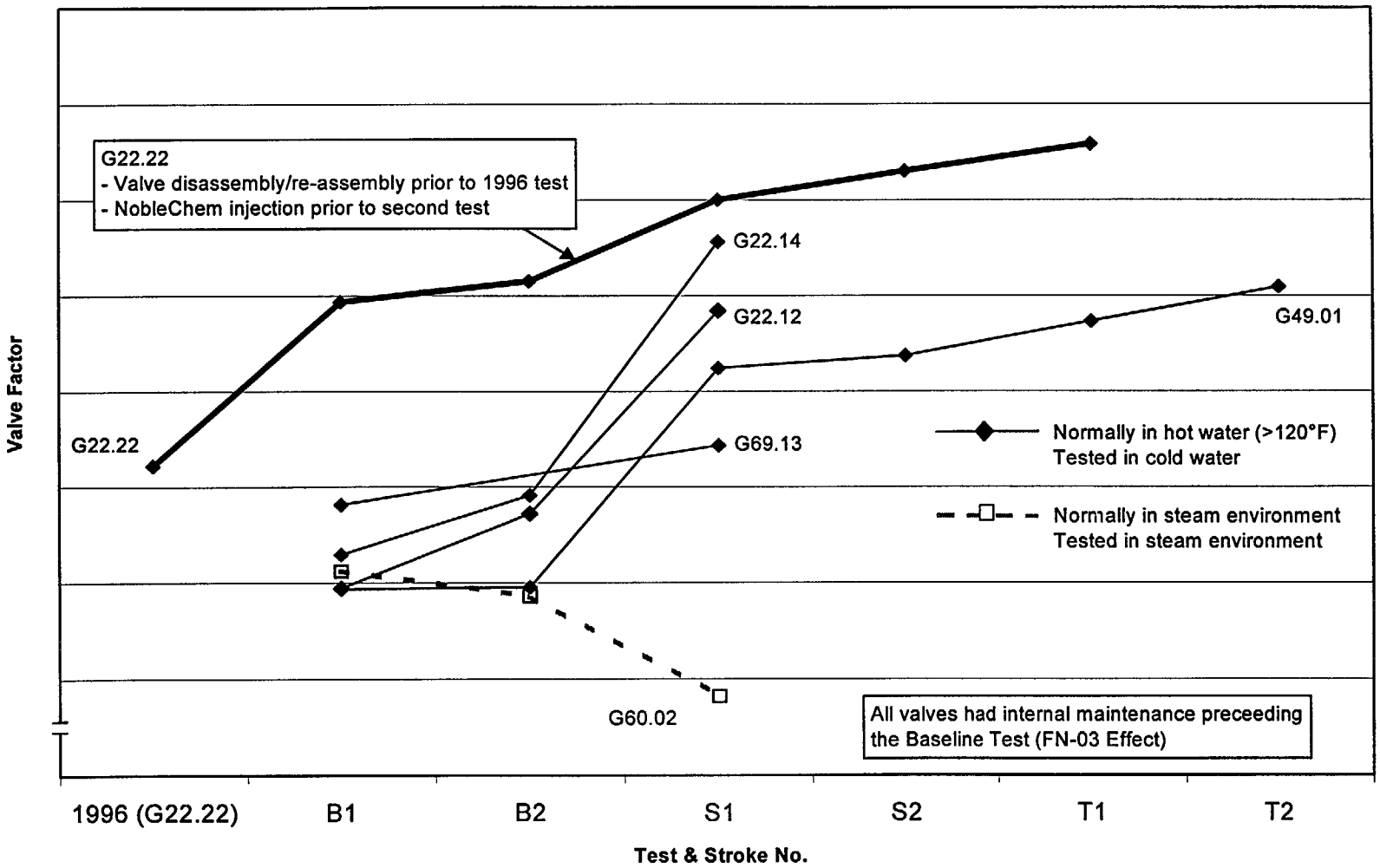
Influence of NobleChem Injection

- Two JOG valves have repeat test data after exposure to NobleChem
  - G22.21 (1st & 2nd test) - NobleChem prior to second test
    - Shows stable valve factors
  - G22.22 (1st, 2nd & 3rd test) - NobleChem prior to second test only
    - Disassembled one outage prior to baseline test
    - NobleChem injection closer to valve than G22.21
    - Shows behavior consistent with FN-03
- **Conclusion - no evidence that NobleChem has an influence on valve factor**

Influence of NobleChem Injection (cont'd)
Progression of Valve Factors for G22.22



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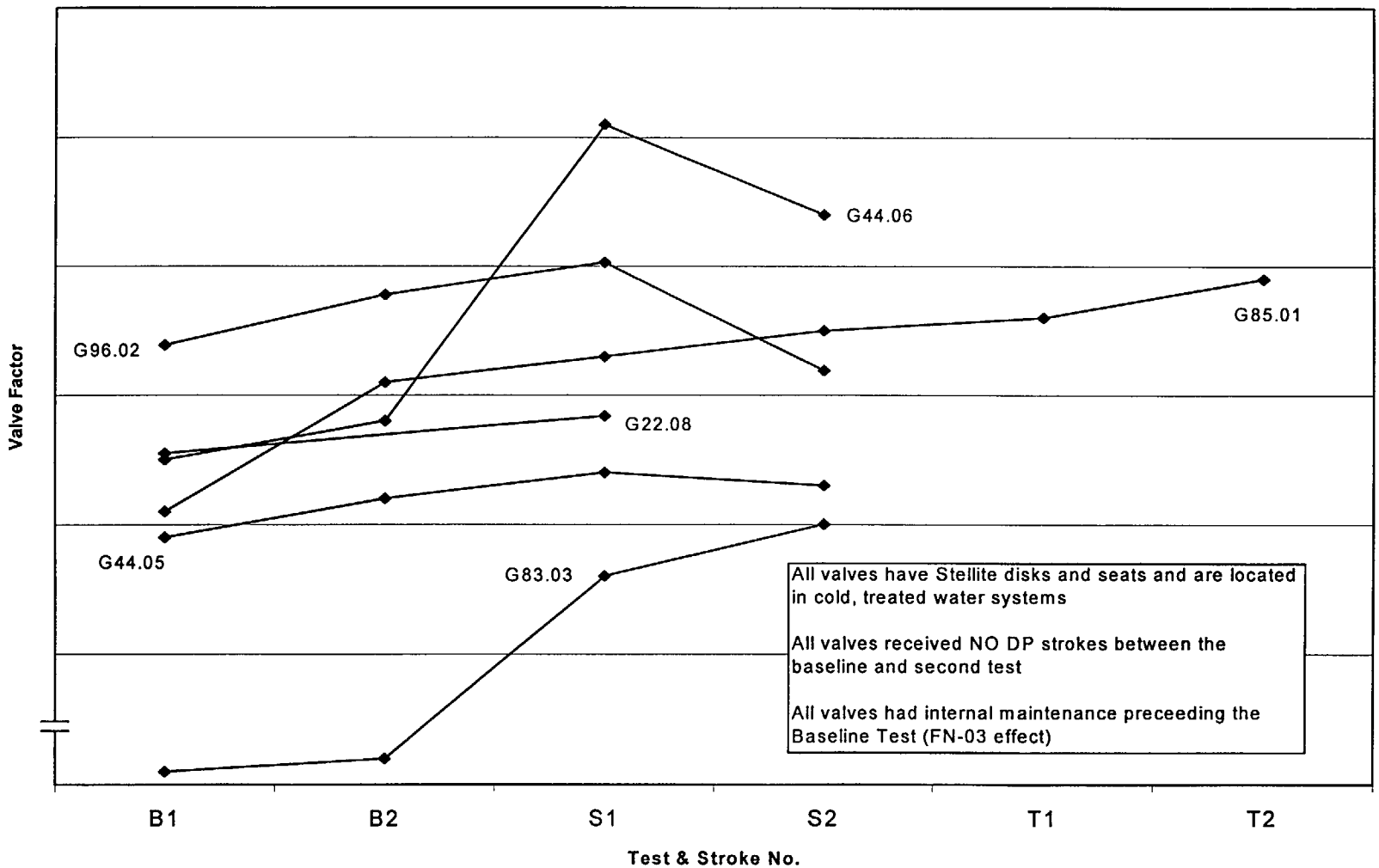
Progression of Closing Valve Factor at Initial Wedging - Stellite Seats/Cold Treated Water/No DP Strokes - Internal Maintenance Prior to Baseline Test (FN-03 Effect)



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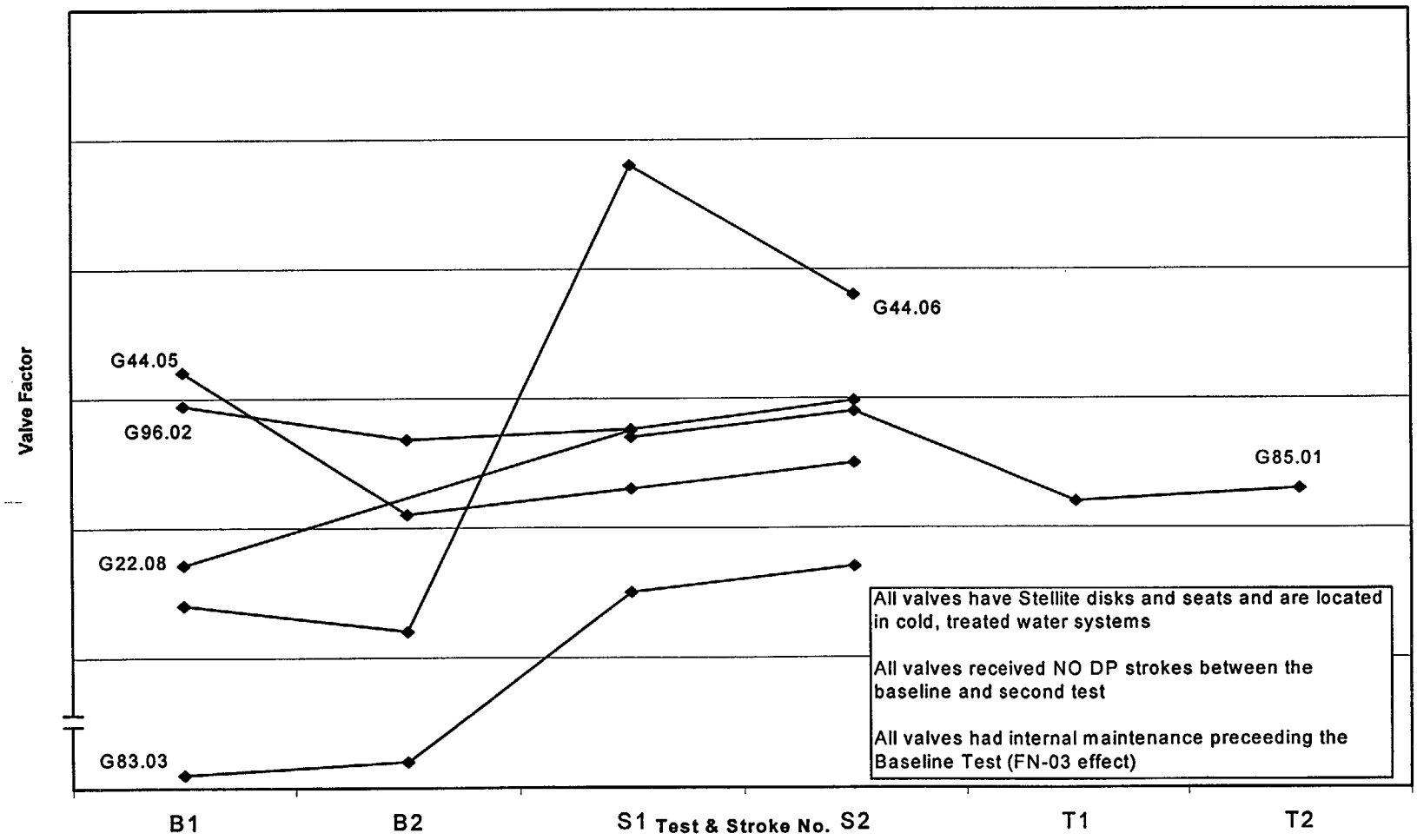
Progression of Opening Valve Factor at Flow Initiation - Stellite Seats/Cold Treated Water/No DP Strokes - Internal Maintenance Prior to Baseline Test (FN-03 Effect)



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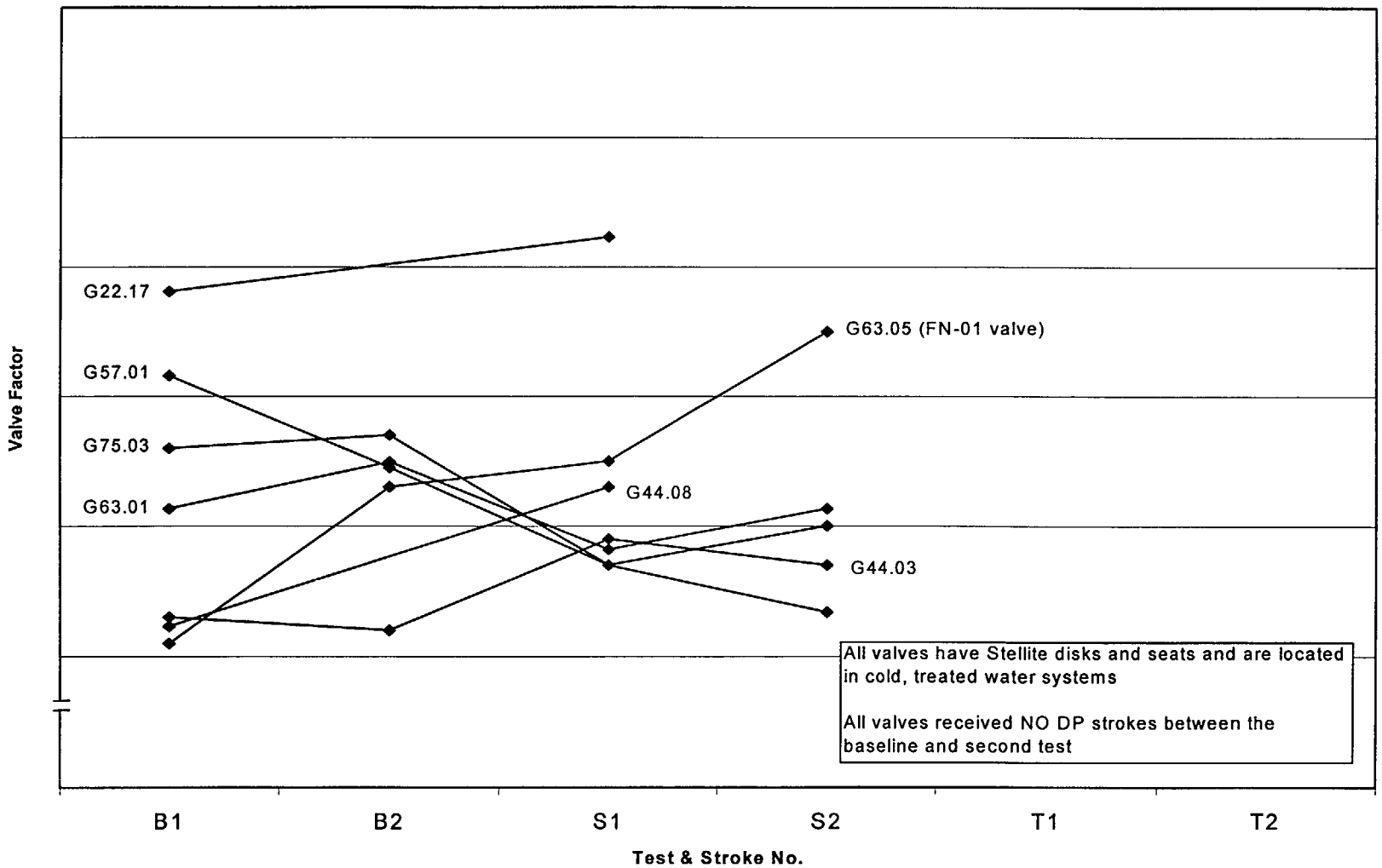

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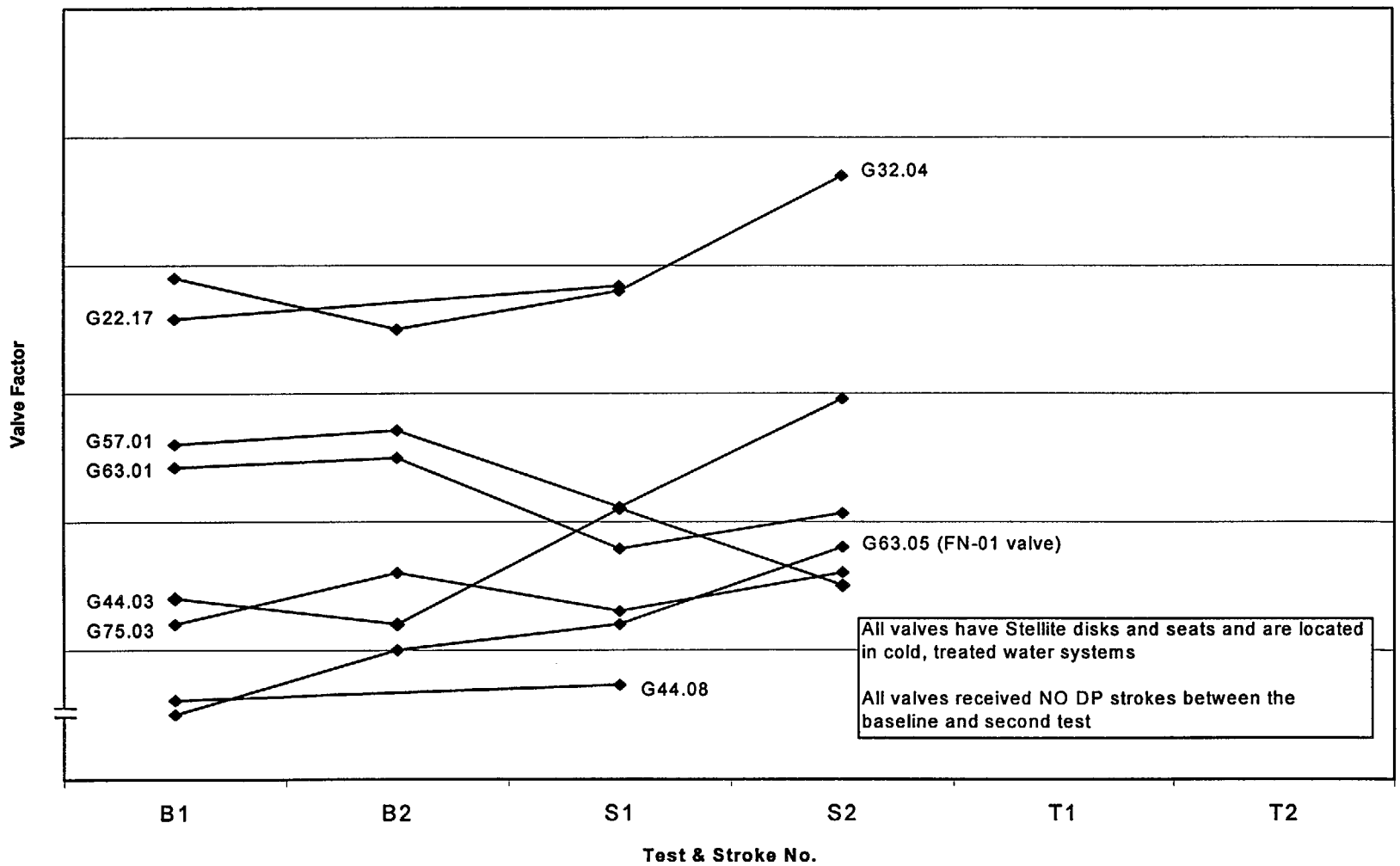

All valves have Stellite disks and seats and are located in cold, treated water systems

All valves received NO DP strokes between the baseline and second test

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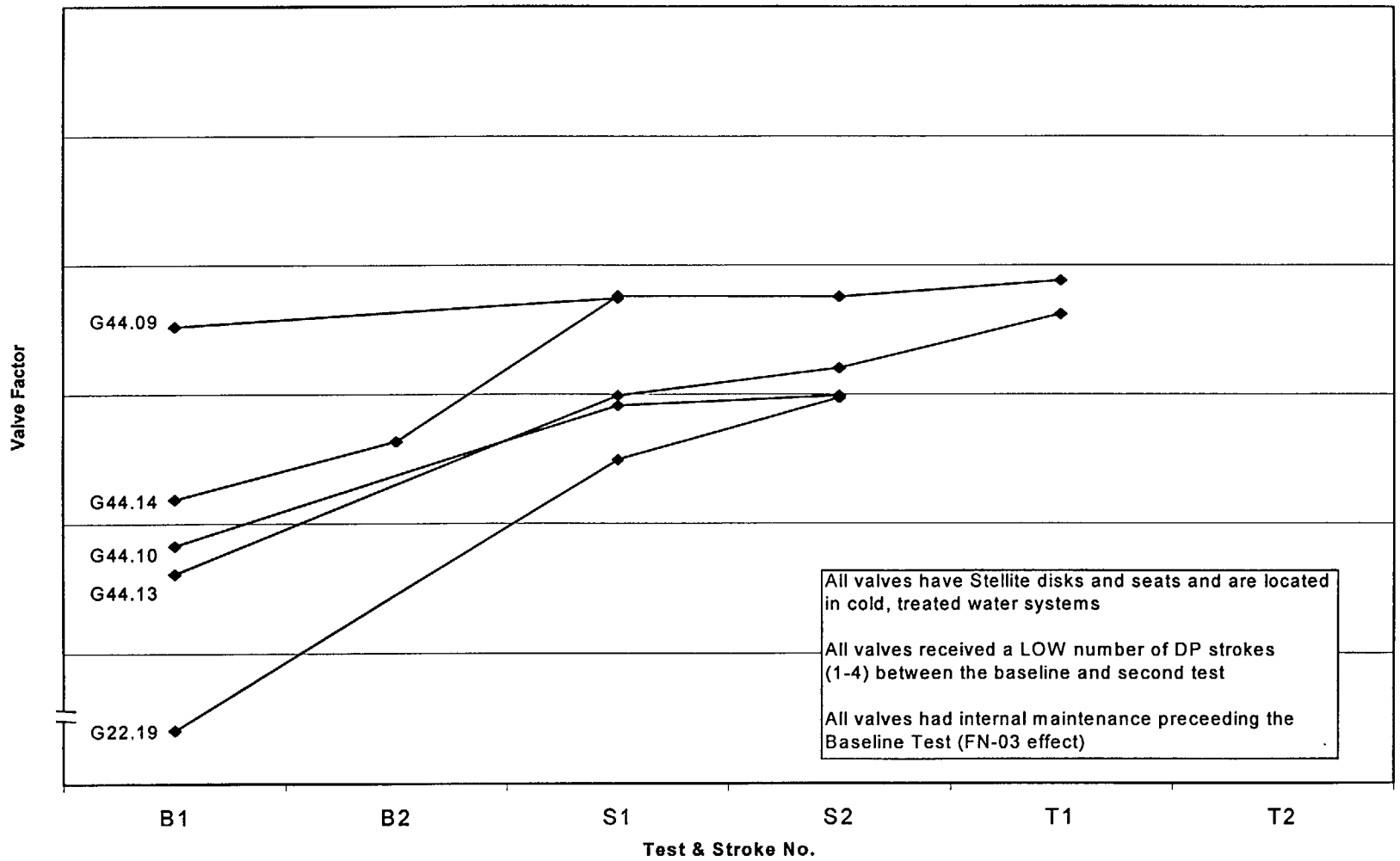
Progression of Closing Valve Factors at Initial Wedging - Stellite Seats/Cold Treated Water/Low DP Strokes - Internal Maintenance Prior to Baseline Test (FN-03 Effect)



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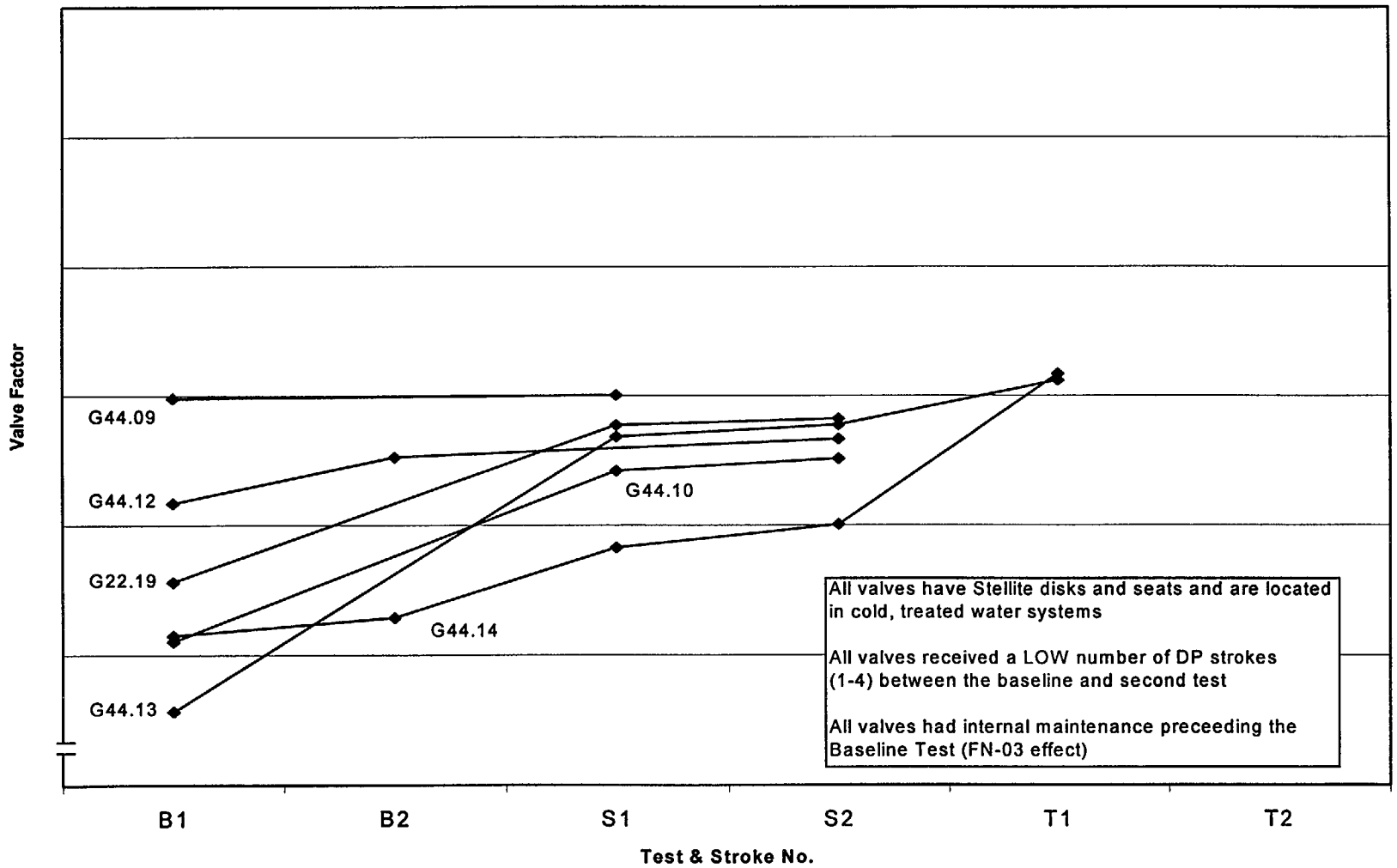

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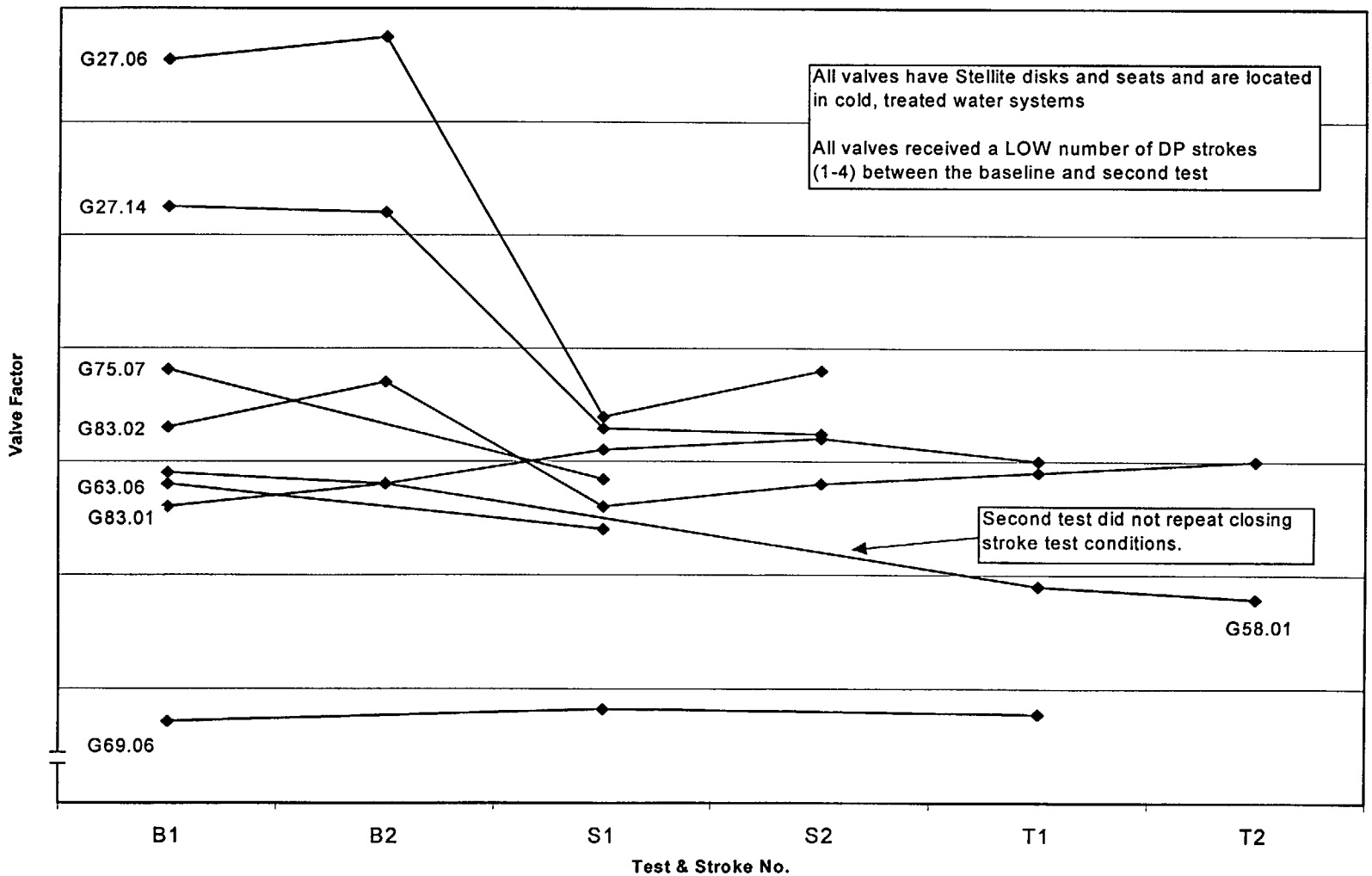

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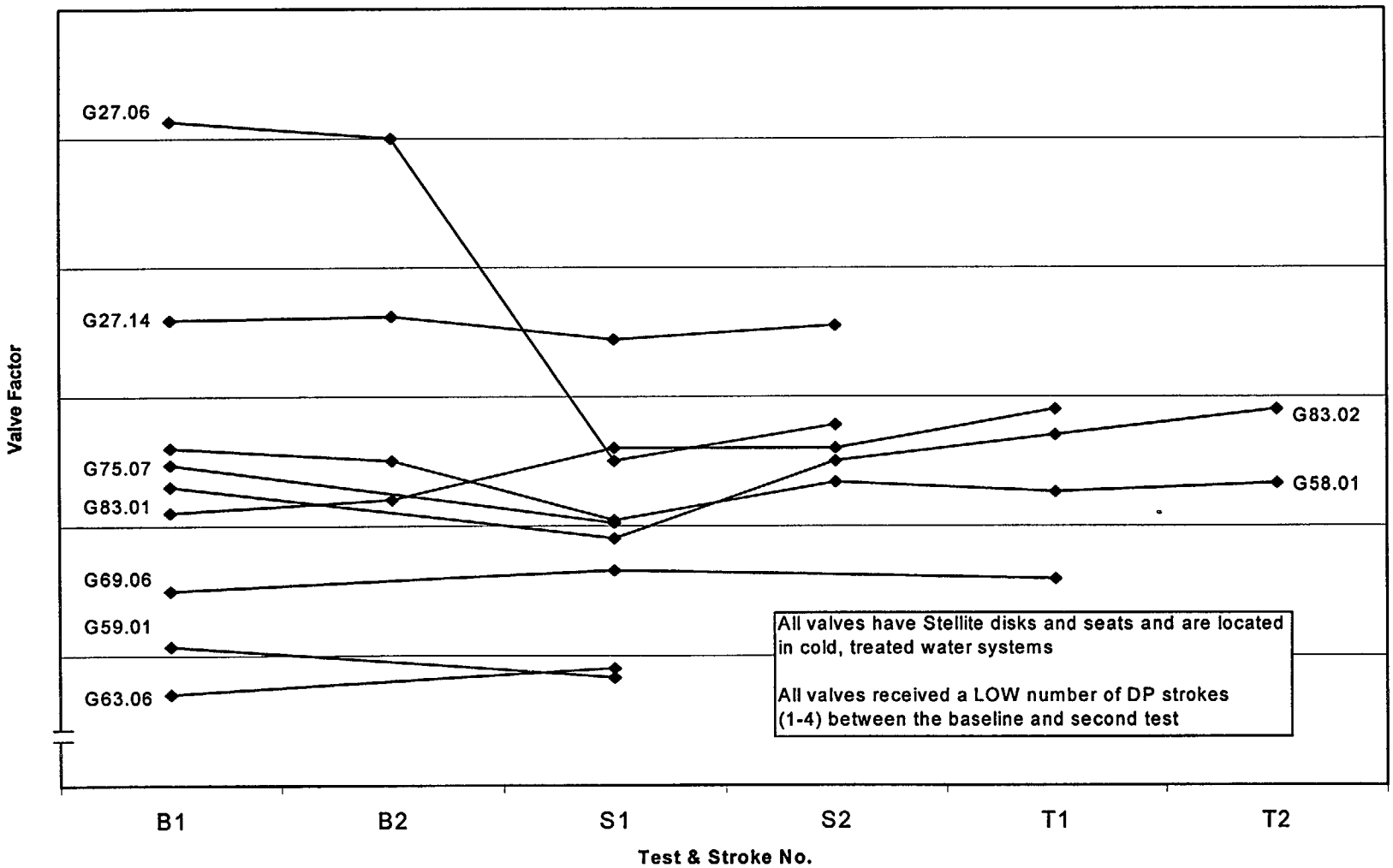
Progression of Opening Valve Factors at Flow Initiation - Stellite Seats/Cold Treated Water/Low DP Strokes - No Internal Maintenance Prior to Baseline Test



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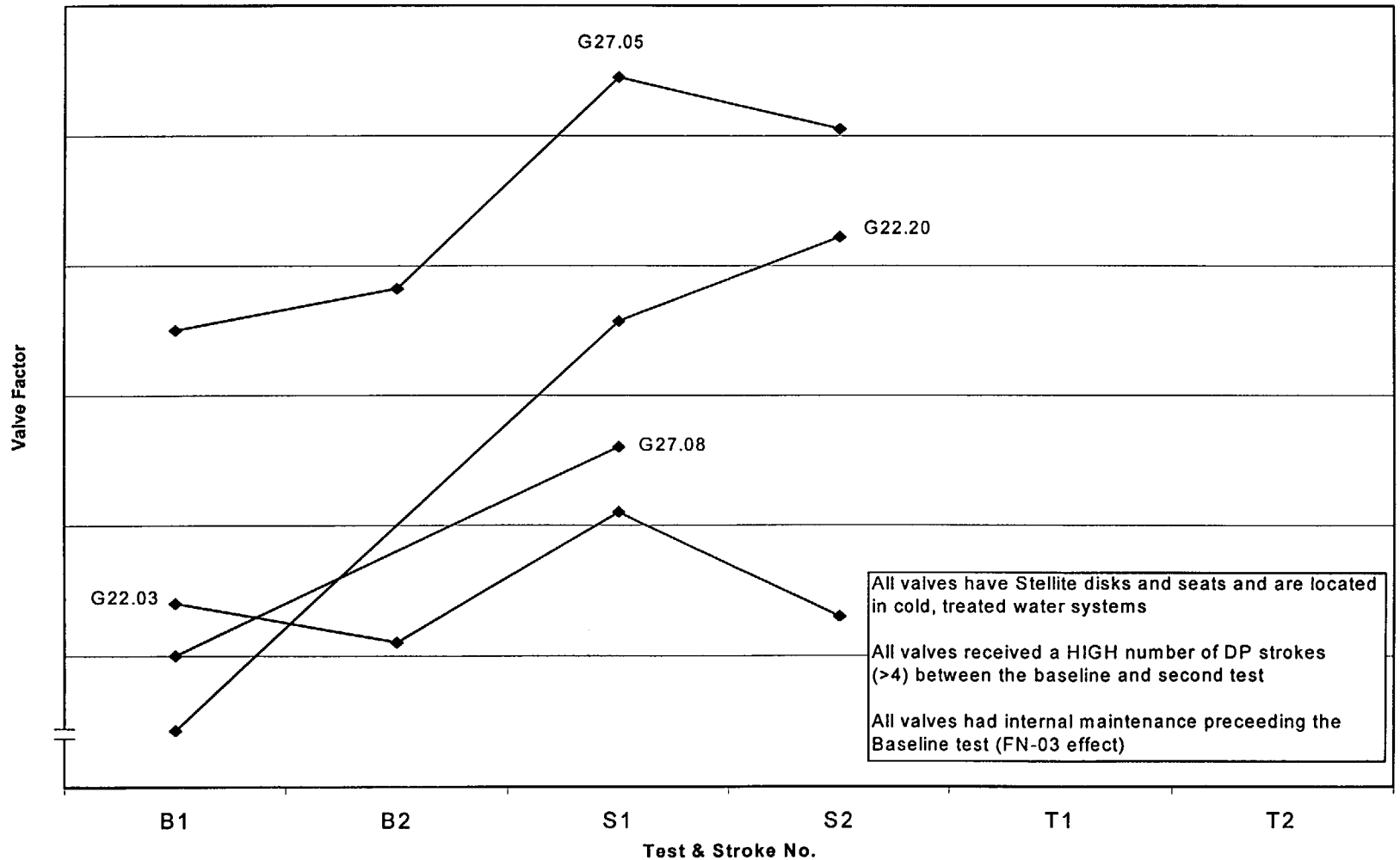
Progression of Closing Valve Factors at Initial Wedging - Stellite Seats/Cold Treated Water/High DP Strokes - Internal Maintenance Prior to Baseline Test (FN-03 Effect)



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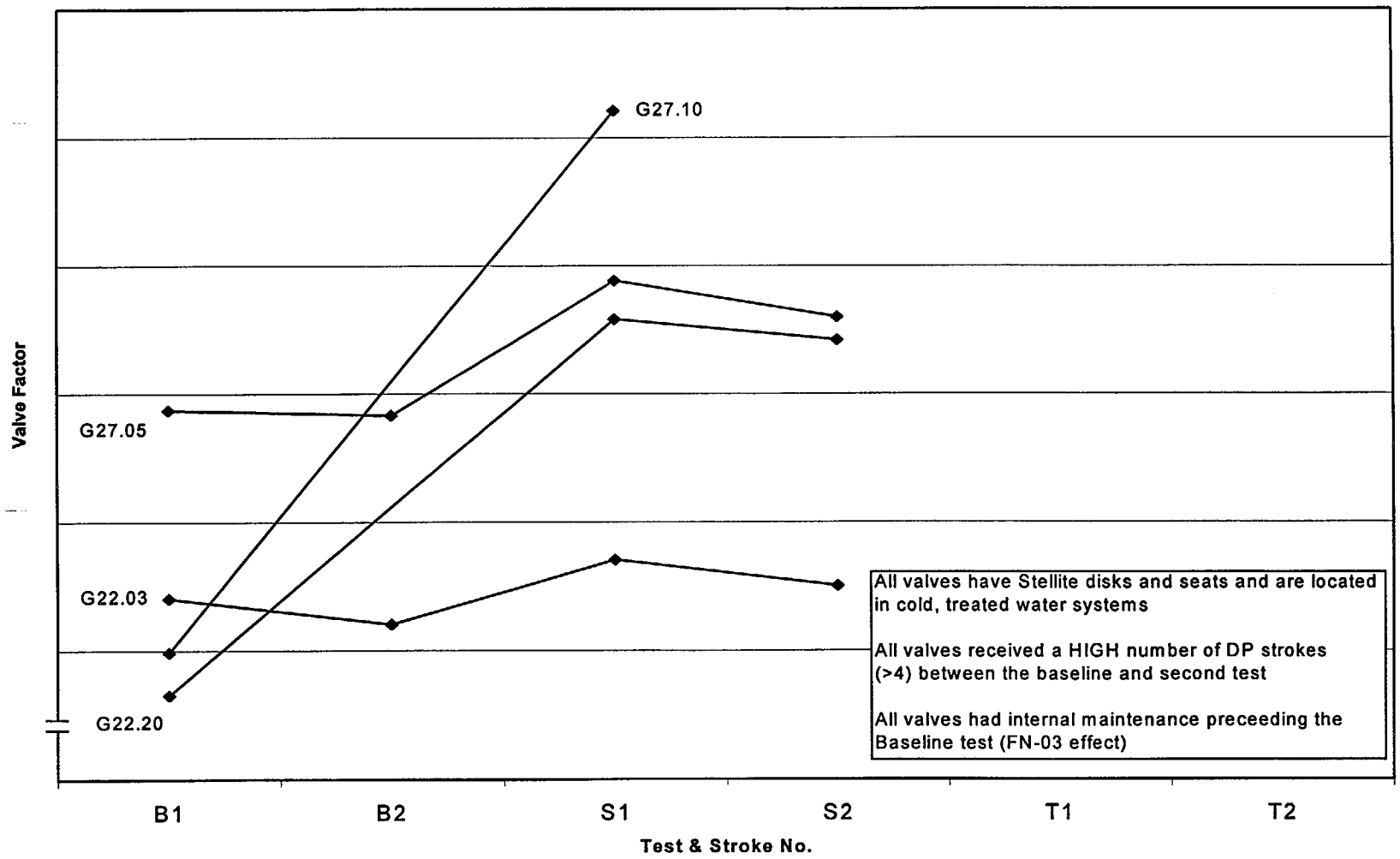

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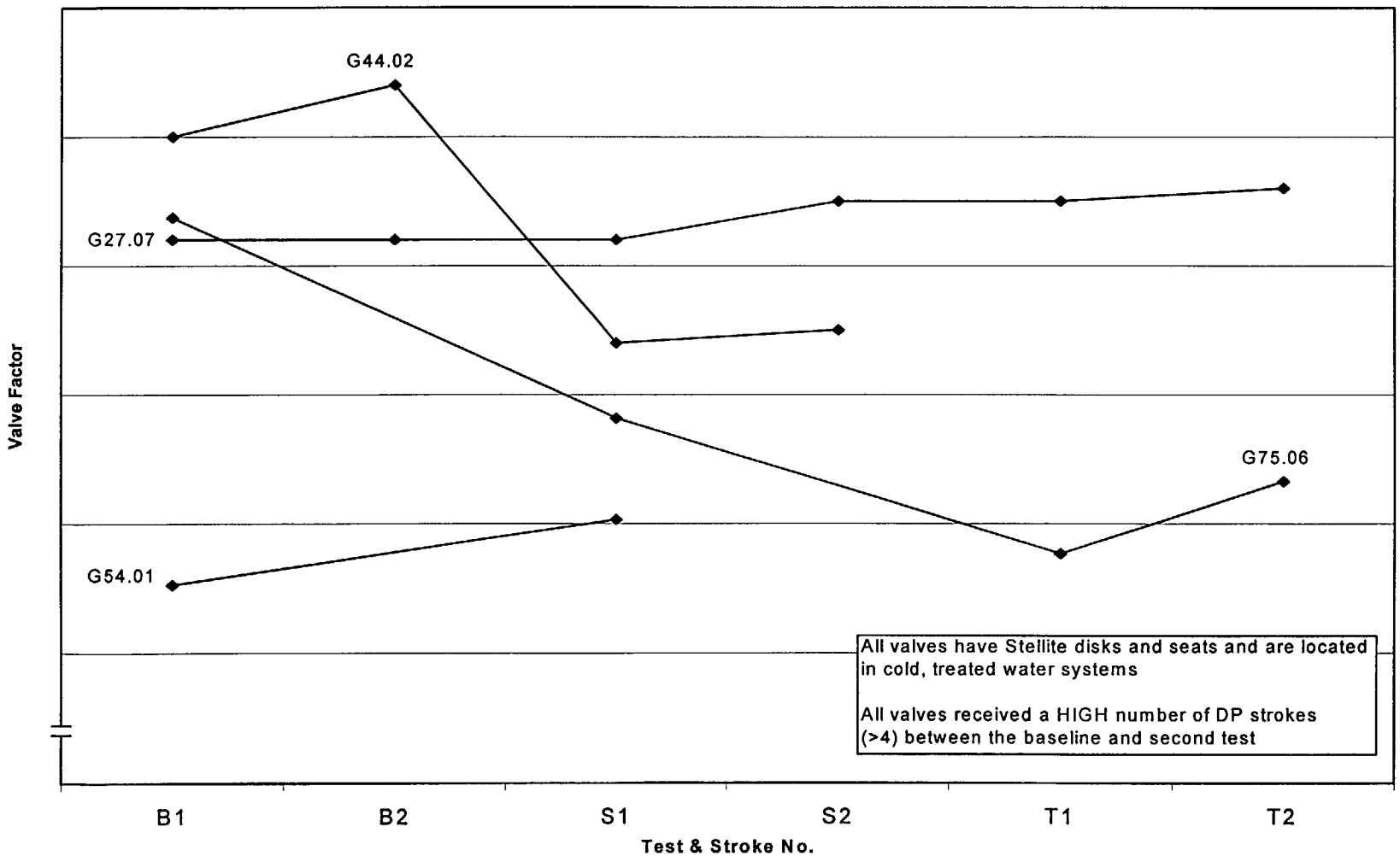
Progression of Closing Valve Factors at Initial Wedging - Stellite Seats/Cold Treated Water/High DP Strokes - No Internal Maintenance Prior to Baseline Test



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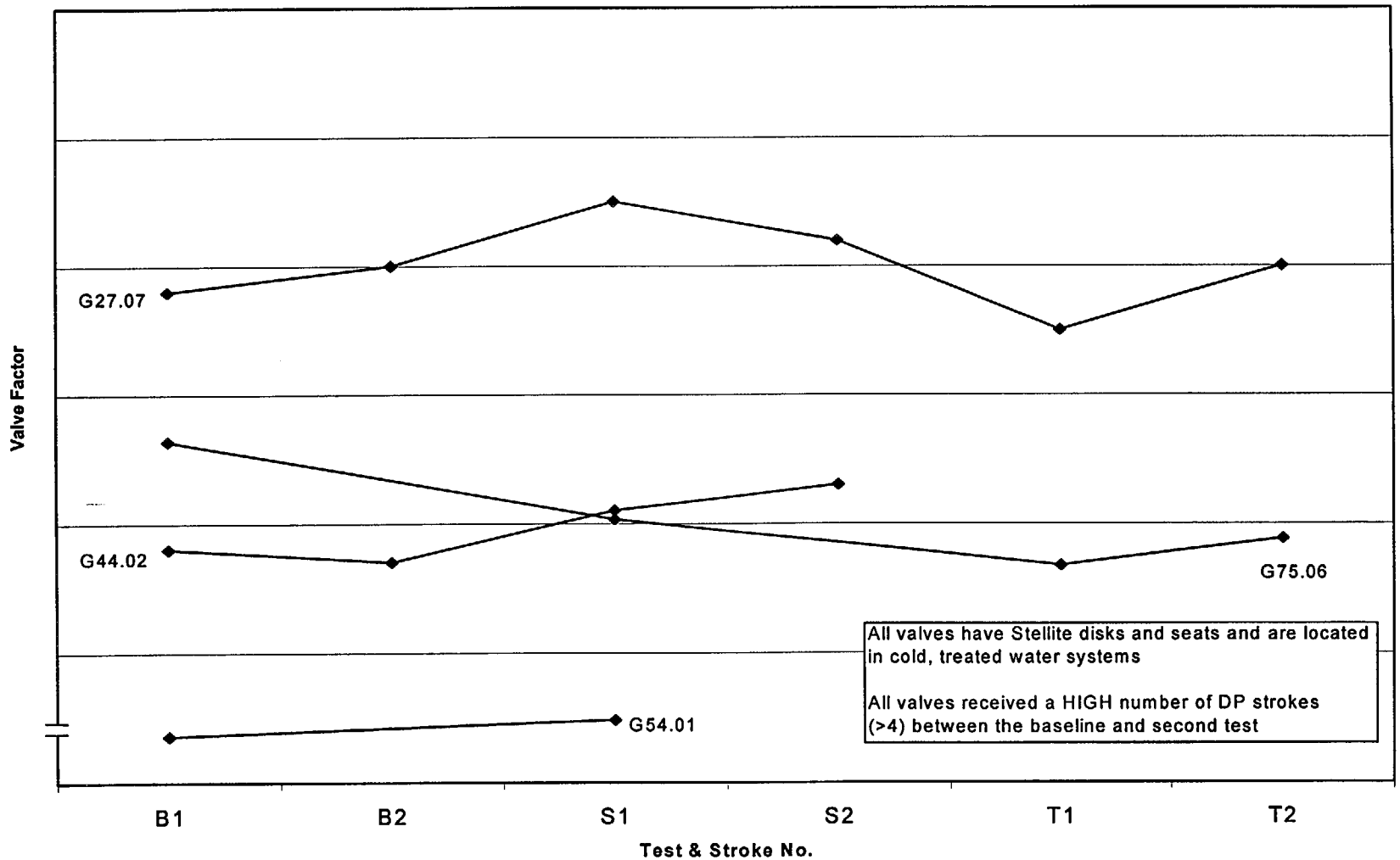

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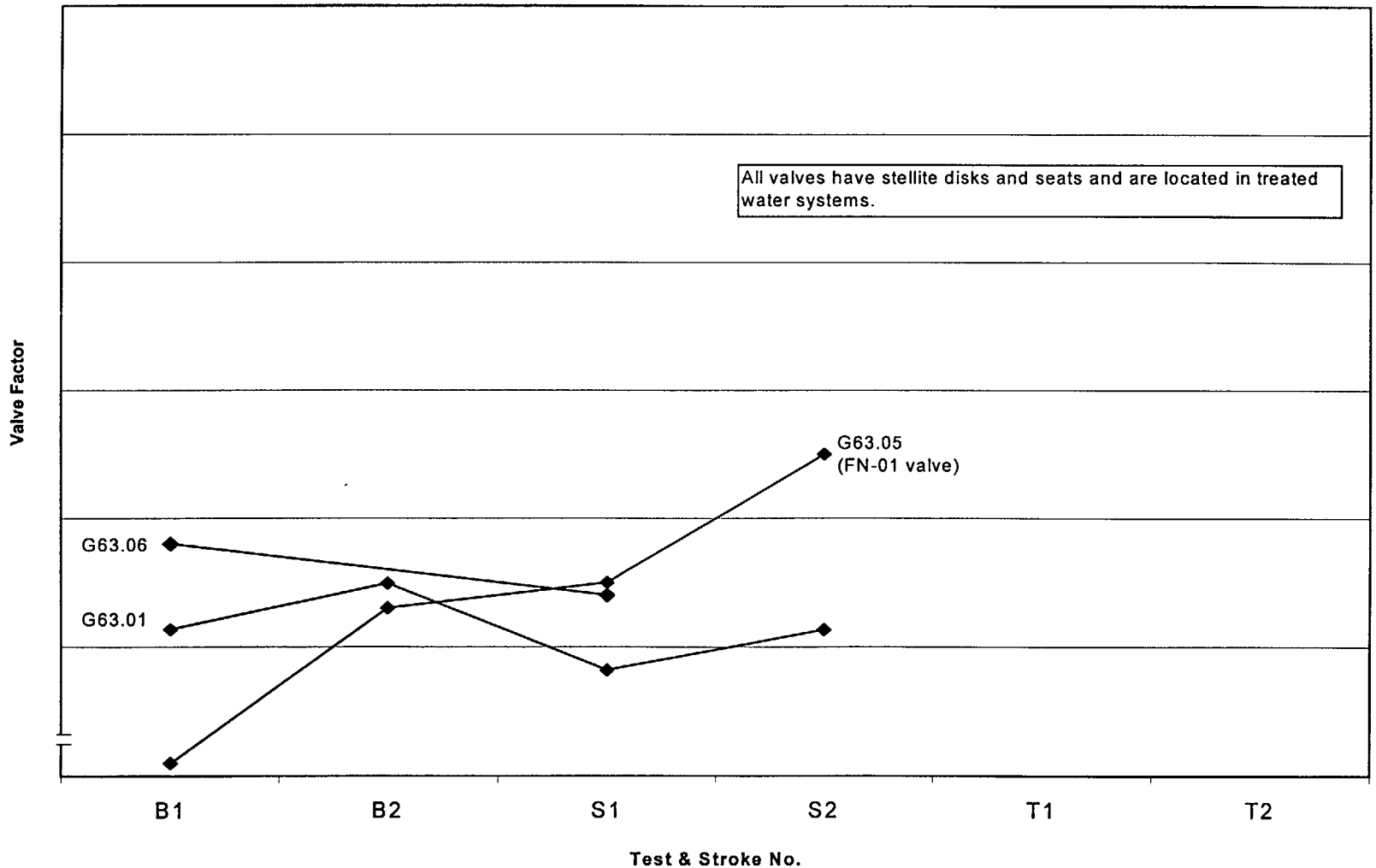
Progression of Closing Valve Factor at Initial Wedging - Split Wedge Valves



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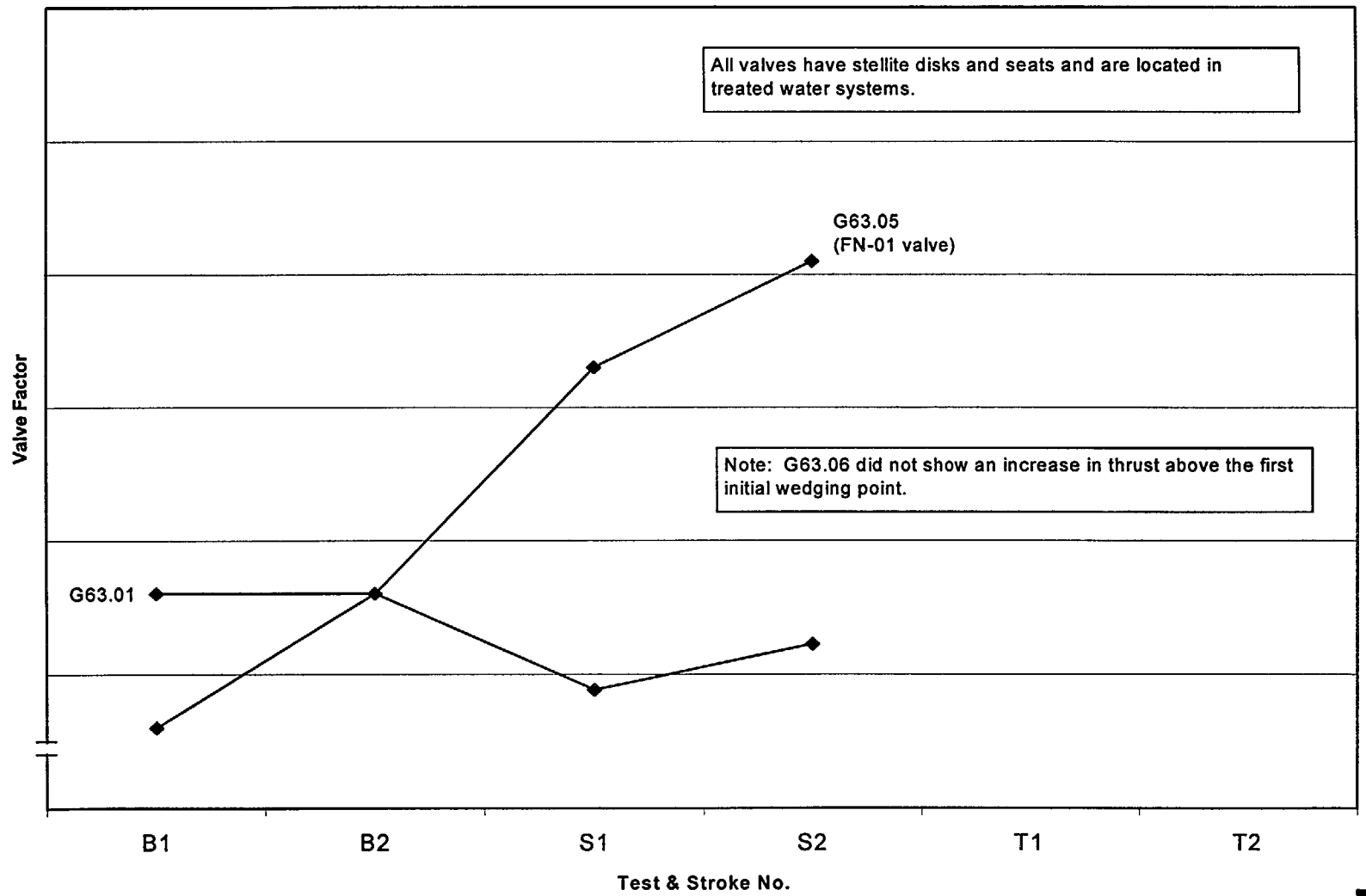
Progression of Closing Valve Factor at Initial Wedging, Point 2 - Split Wedge Valves



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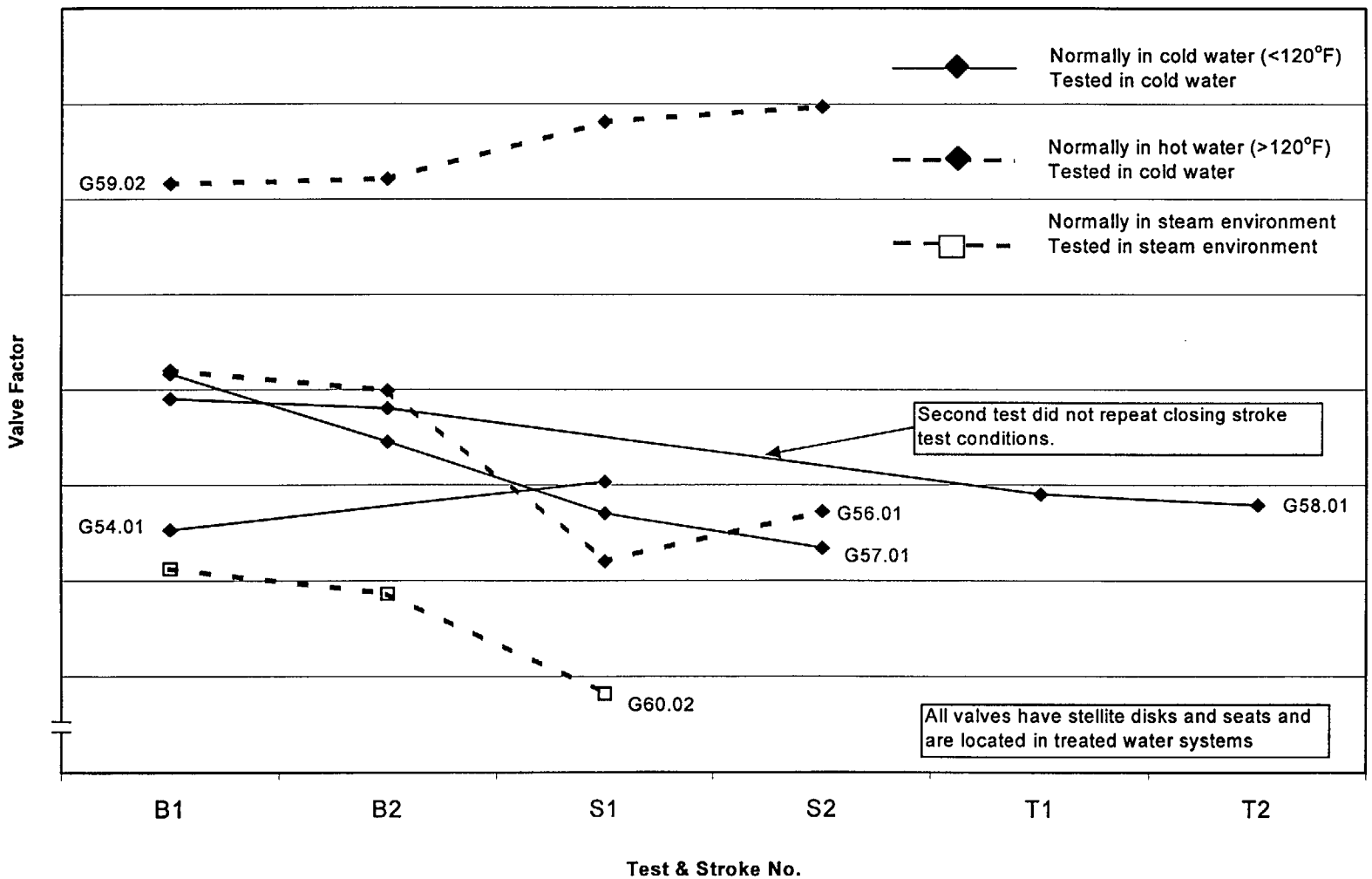
Progression of Closing Valve Factor at Initial Wedging - Double Disk Gate Valves



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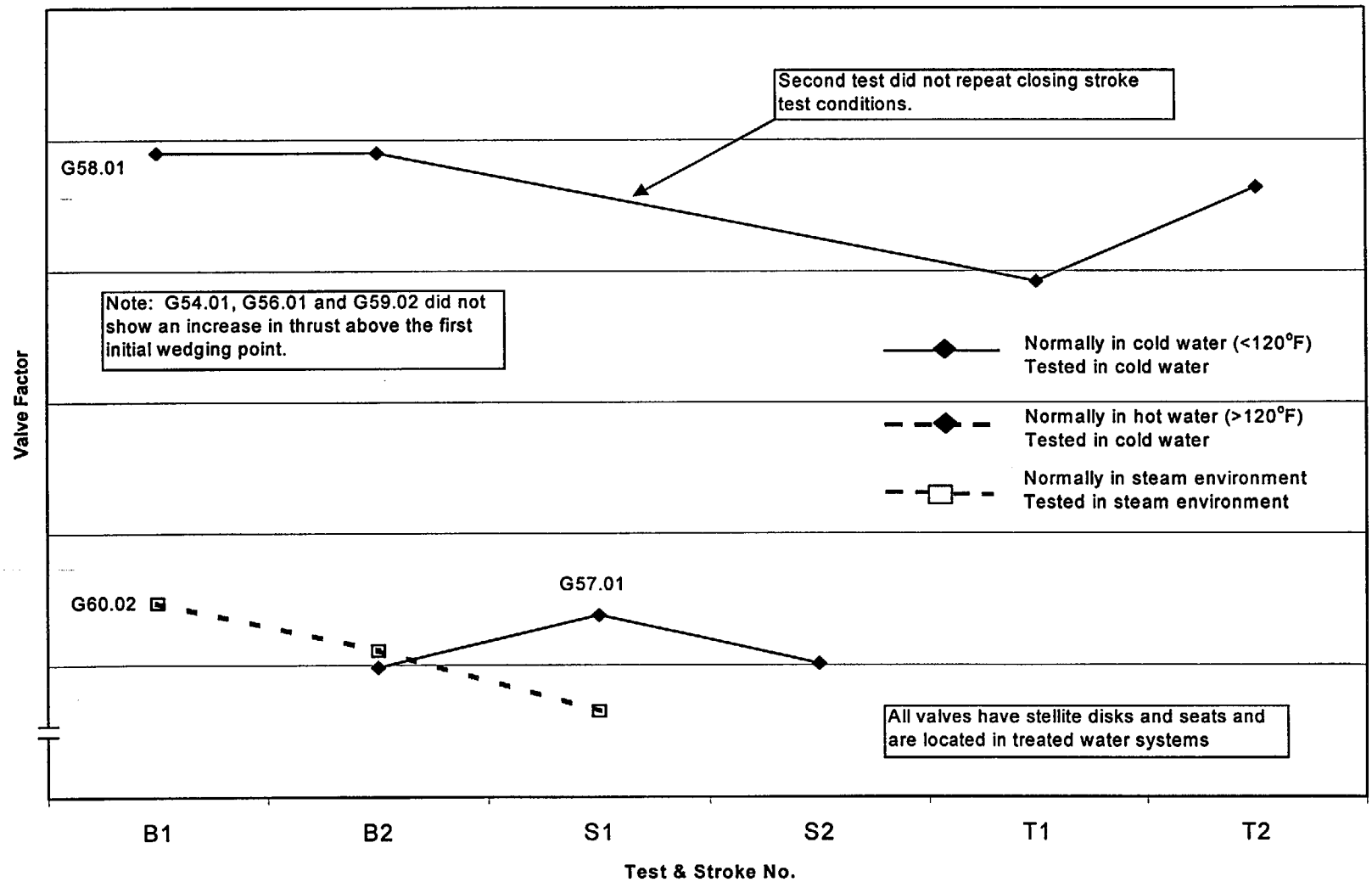

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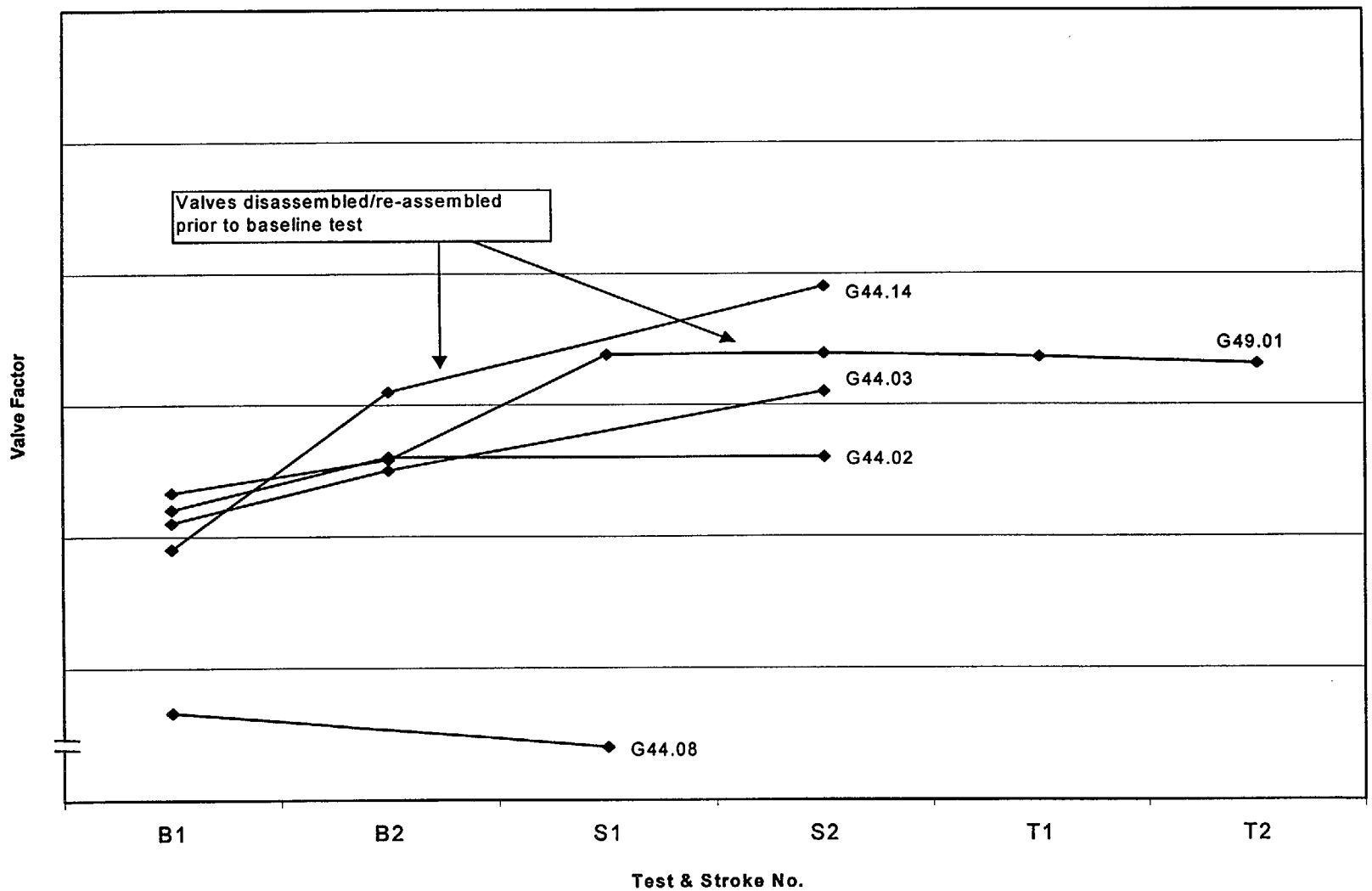
Gate Valve Test Results

Guide Friction Evaluation

- Flexible and solid wedge gate valve repeat test data evaluated to identify instances of guide-controlled VFs
- Limited repeat data for most material pairs
- 300 SS disk guide vs 300 SS body guide pairs - 5 valves with repeat data
  - Guide friction bounds seat friction
  - Possible effect of valve disassembly/re-assembly (FN-03?)
- Stellite disk guide with various body guide - 3 valves with repeat data
  - no degradation

Progression of Valve Factors at Maximum After Cracking Attributable to Guide Friction - Stainless Steel Disk & Body Guides



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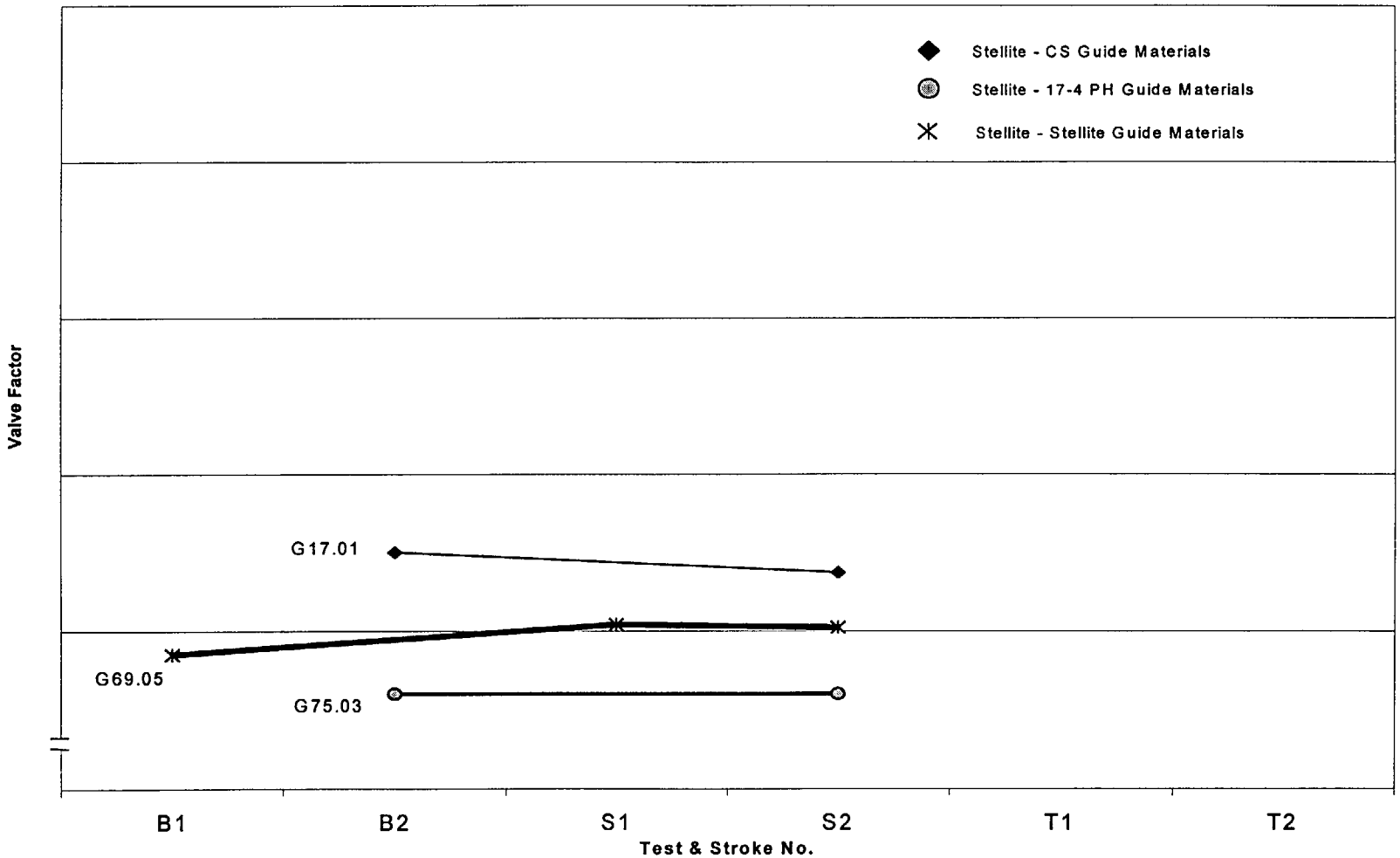
Progression of Valve Factors at Maximum After Cracking Attributable to Guide Friction - Stellite Disk Guide Material



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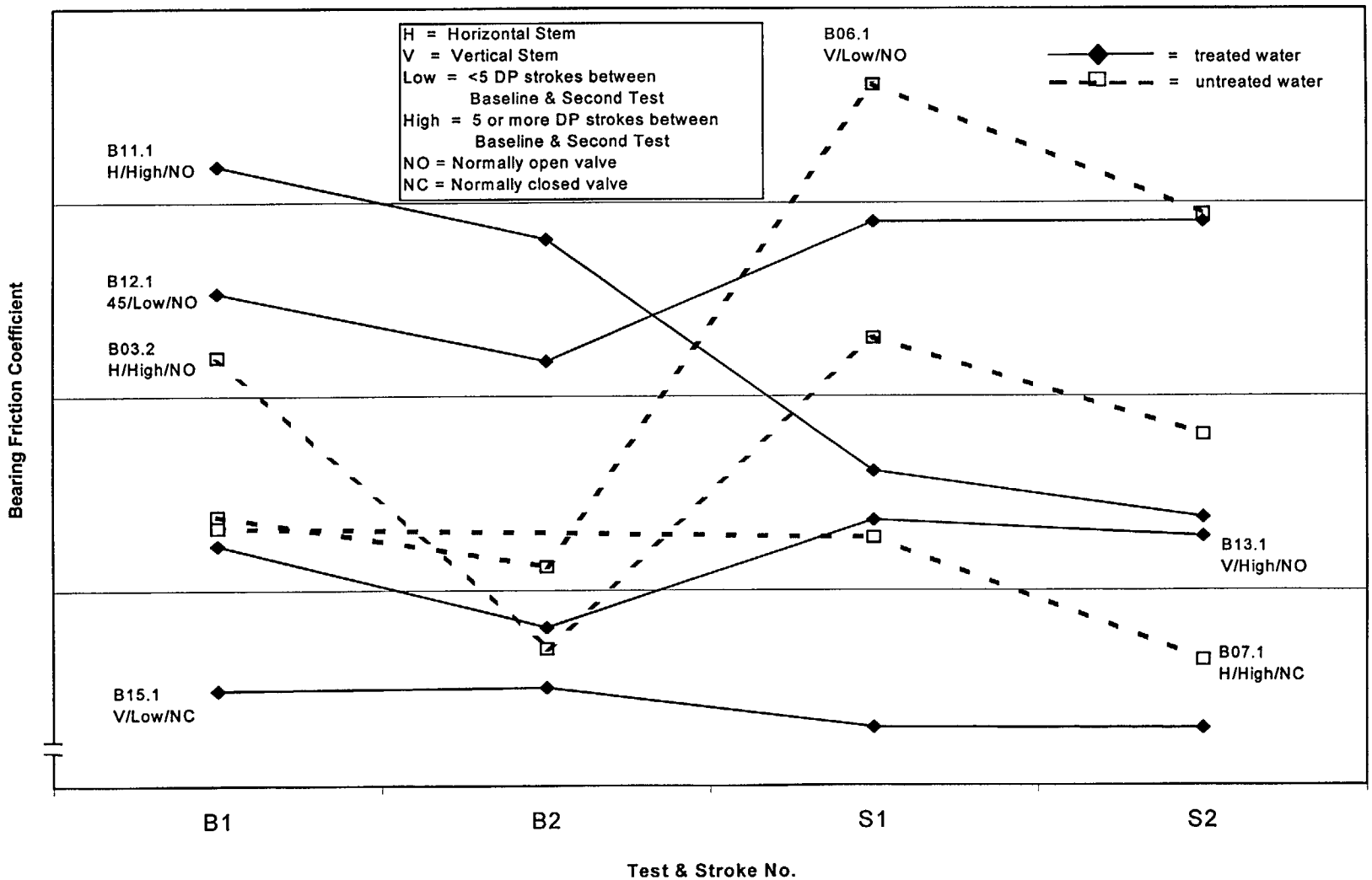
Butterfly Valve Test Results

- Data is separated by bearing material
  - Bronze and Non-Bronze
- Bronze Bearings
  - Treated water systems
    - Bearing friction coefficient is stable or decreasing
  - Untreated water systems
    - Bearing friction coefficient varies significantly
    - Data under further investigation to determine if there is a degradation trend
- Non-Bronze Bearings
  - Bearing friction coefficient is stable or decreasing

Progression of Bearing Friction Coefficient for Butterfly Valves - Bronze Bearings



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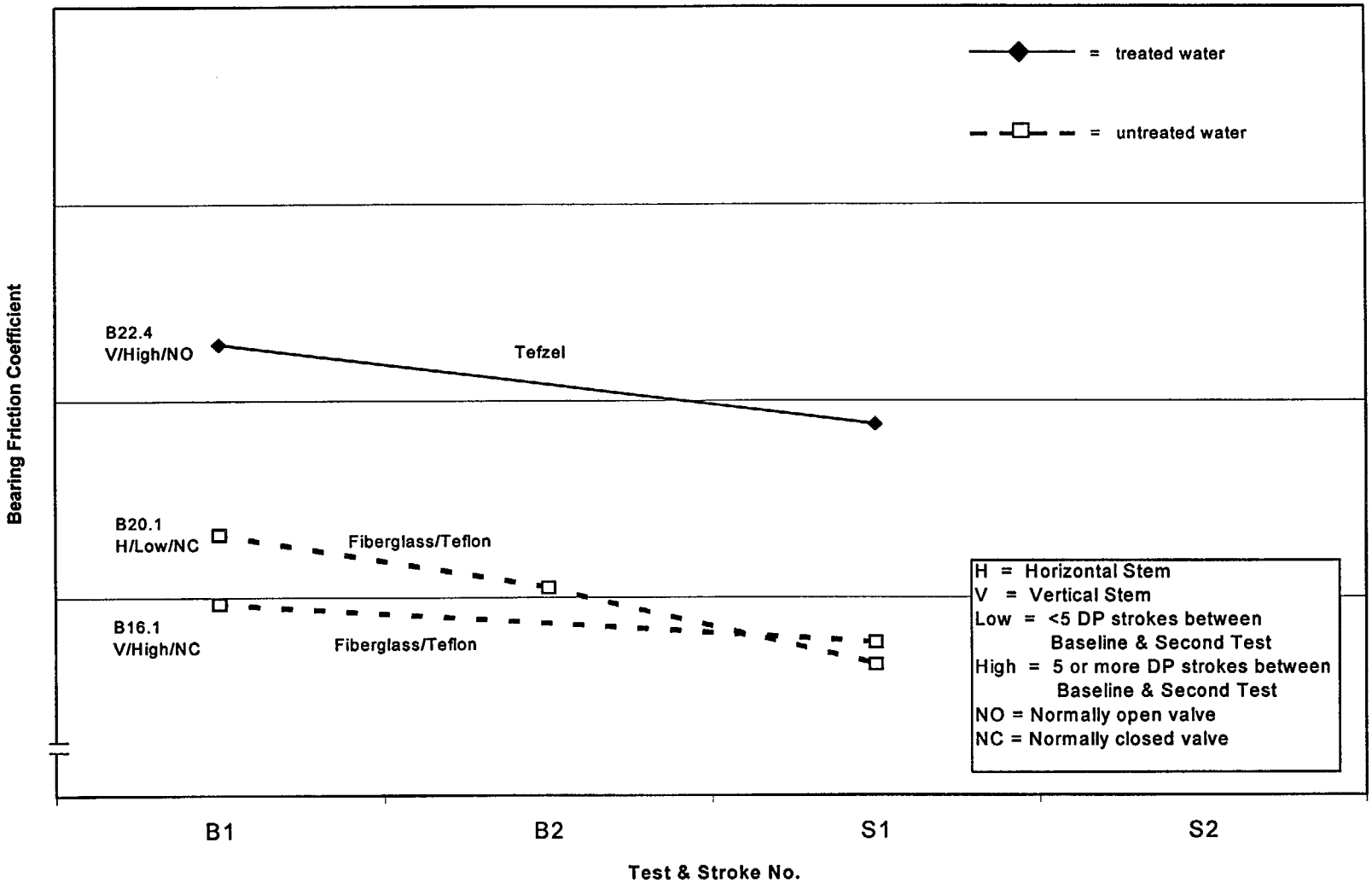
Progression of Bearing Friction Coefficient for Butterfly Valves - Non-Bronze Bearings



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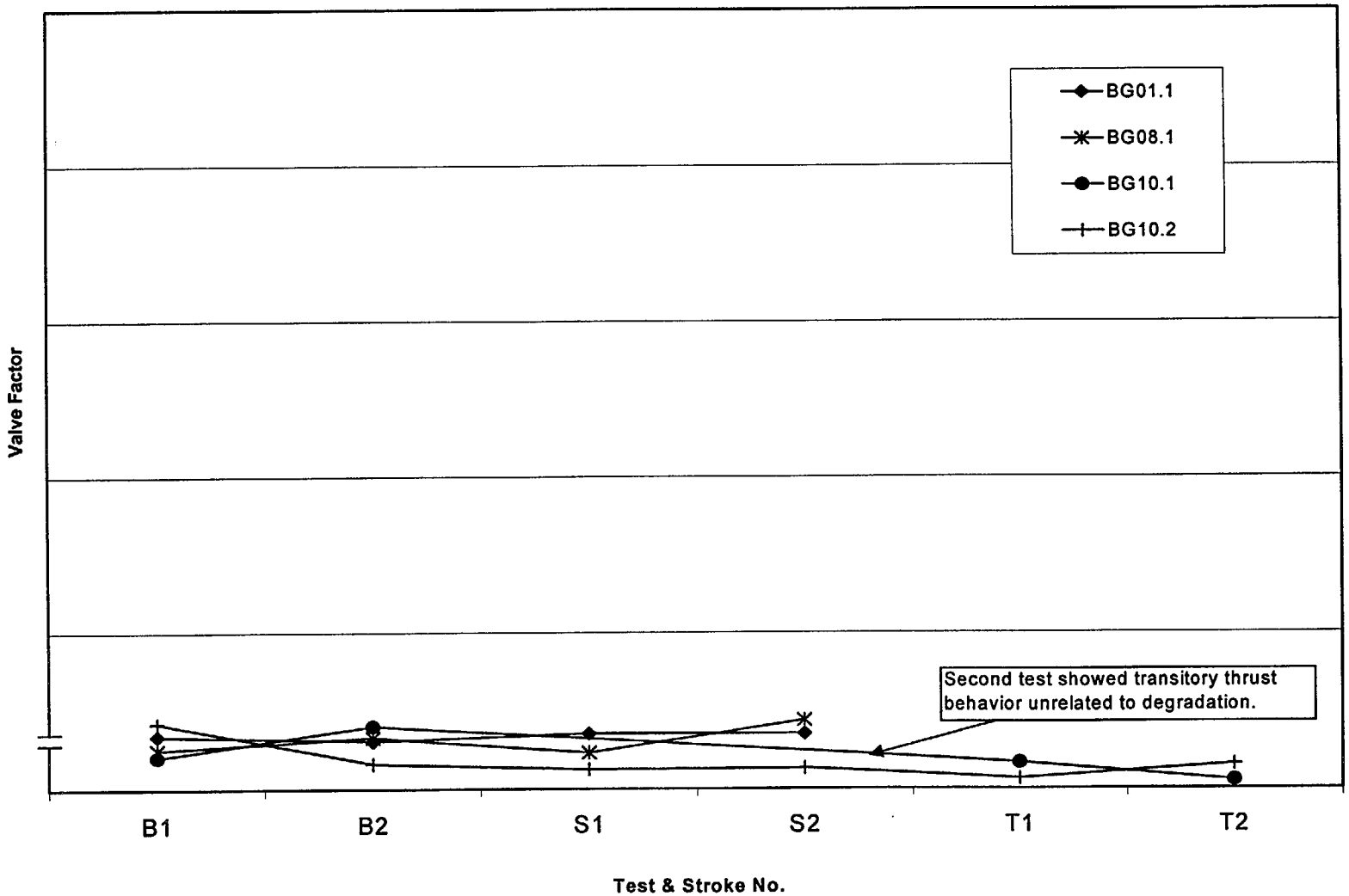
Balanced Disk Globe Valve Test Results

- Low thrust values
- Low valve factors showing small changes
  - No Degradation
- Two raw water valves (BG10.1 and 10.2) showed transitory thrust increases not related to degradation
  - BG10.1 (during seating of second test)
    - Third test valve factors similar to baseline
  - BG10.2 (during opening running portion) - VFs in unseating (DP thrust) region similar for all three tests
  - Observed behavior attributed to sediment or other foreign material

Progression of Valve Factor for Balanced Disk Globe Valves at Seating



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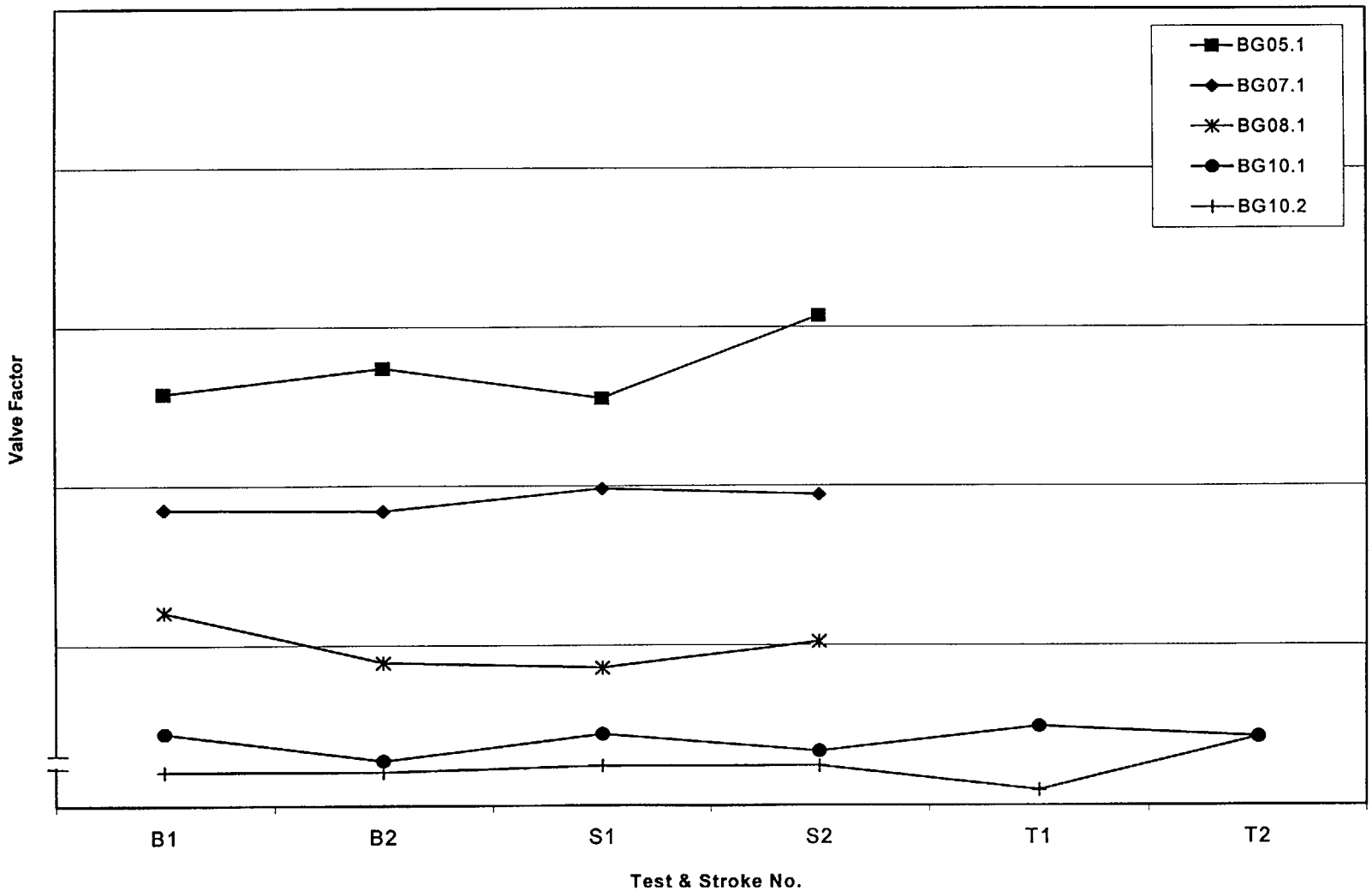
Progression of Valve Factor for Balanced Disk Globe Valves at Unseating



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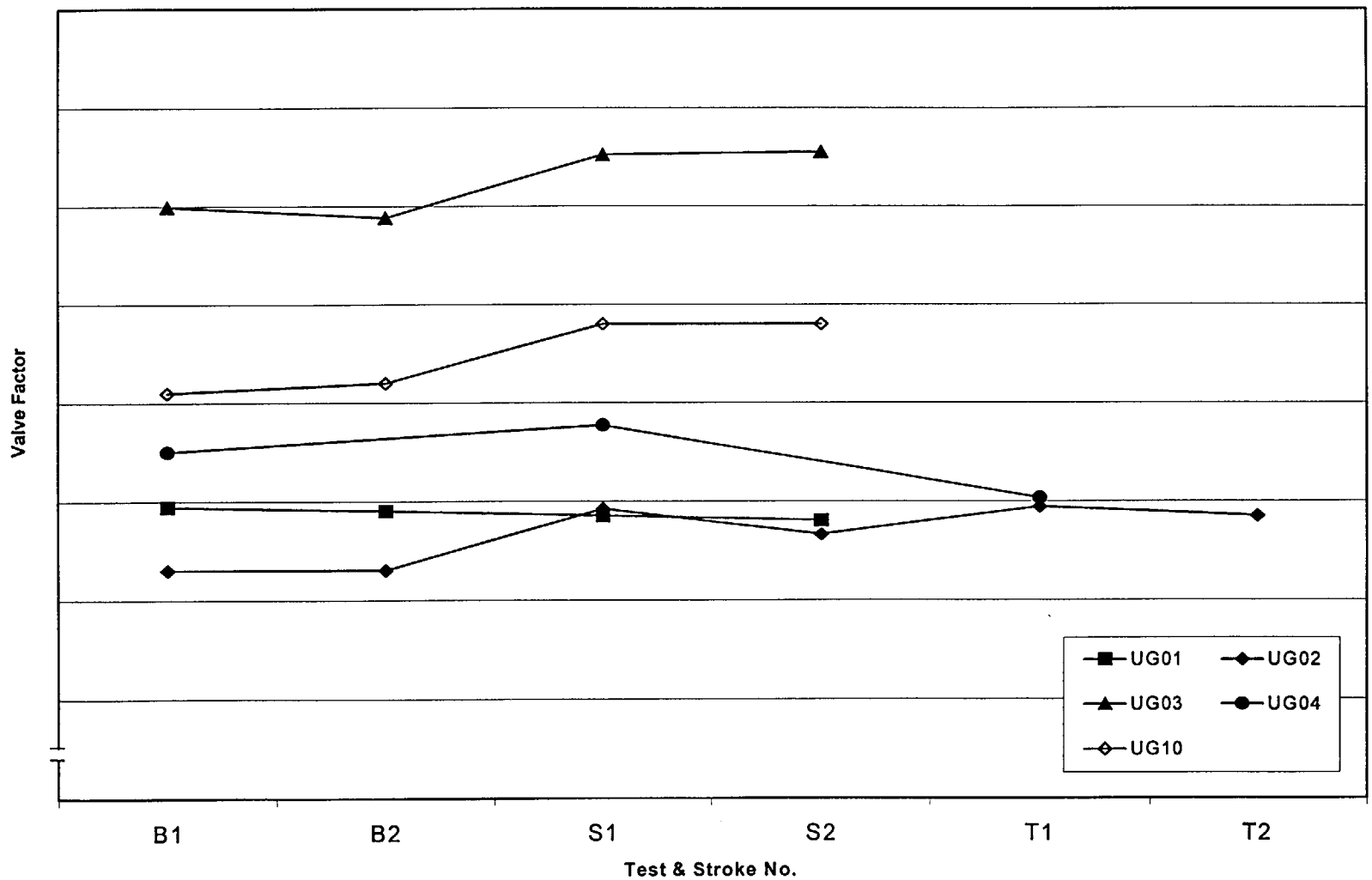
Unbalanced Disk Globe Valve Test Results

- Small changes in valve factor
- All changes to date appear to be within instrument uncertainty
- No evidence of degradation (consistent with Topical Report conclusion of no degradation mechanisms)
- Sufficient data does not yet exist to justify discontinuation of water flow testing

Progression of Valve Factor for Unbalanced Disk Globe Valves at Seating (underseat flow)



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JOG PV Program Closure

- At conclusion of JOG dynamic testing, JOG will evaluate all test results
- JOG conclusions will:
  - Confirm appropriate interim program assumptions
  - Require appropriate modification to interim program

    and
  - Give basis for final program
- JOG will prepare final program report & submit to NRC
- NRC to provide final SER

Table 3-1: Gate Valve Test Matrix

JOG Test Matrix No	Reference	Manufacturer	Size (in)	Class (lb)	Disk Type	Disk Face Material	Seat Face Material	Disk Guide Face Material	Body Guide Face Material	Fluid	DP Strokes Per Year	Stem Orientation	As-Tested Valve Fac
G01.01	moved to G06.01												
G01.02		Velan	6	300	Flexible Wedge	Stellite	Stellite	Carbon Steel	Carbon Steel	untreated water	0	Vertical	High
G06.01		Velan	12	150	Flexible Wedge	Stellite	Stellite	Carbon Steel	Carbon Steel	untreated water	0	Horizontal	Low
G06.02		Velan	12	150	Flexible Wedge	Stellite	Stellite	Carbon Steel	Carbon Steel	untreated water	0	Horizontal	Low
G08.01		Anchor/Darling	16	150	Flexible Wedge	Stellite	Stellite	Carbon Steel	Carbon Steel	untreated water	4	Vertical	High
G08.02		Velan	8	150	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	untreated water	10	Vertical	High
G10.01		Anchor/Darling	18	150	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	untreated water	10	Horizontal	Low
G10.02		Anchor/Darling	18	150	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	untreated water	10	Horizontal	High
G10.03	replaced by G06.02												
G12.01		Velan	6	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	untreated water	0	Vertical	High
G15.01		Velan	12	150	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	untreated water	0	Horizontal	High
G15.02	moved to G10.03												
G17.01		Walworth	24	150	Solid Wedge	Stellite	Stellite	Stellite	Carbon steel	untreated water	1	Vertical	Low
G17.02		Walworth	20	150	Solid Wedge	Stellite	Stellite	Stellite	Carbon steel	untreated water	> 1	Vertical	Low
G20.01		Borg-Warner	4	300	Flexible Wedge	Stellite	Stellite	Carbon Steel	17-4 PH	untreated water	4	Vertical	
G22.01		Velan	6	150	Flexible Wedge	Stellite	Stellite	Carbon Steel	Carbon Steel	treated/closed loop water	0	Horizontal	High
G22.02	moved to G27.14												
G22.03		Borg-Warner	8	150	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	1	Horizontal	High
G22.04	moved to G32.04												
G22.05	moved to G91.05												
G22.06	moved to G27.15												
G22.07		Anchor/Darling	12	900	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	0	Horizontal	Low
G22.08		Anchor/Darling	12	900	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	0	Horizontal	Low
G22.09		Walworth	10	150	Solid Wedge	Stellite	Stellite	Carbon Steel	Carbon Steel	treated/closed loop water	0	45 deg	Low
G22.10		Walworth	8	150	Solid Wedge	Stellite	Stellite	Carbon Steel	Carbon Steel	treated/closed loop water	0	45 deg	High
G22.11	moved to G99.07												
G22.12		Anchor/Darling	18	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water		Vertical	Low
G22.13	moved to G27.16												
G22.14		Anchor/Darling	18	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water		Vertical	High
G22.15	moved to G63.05												
G22.16	moved to G63.06												
G22.17		Anchor/Darling	18	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	reactor coolant water	0	20 deg	High
G22.18		Anchor/Darling	10	900	Flexible Wedge	Stellite	Stellite	Carbon Steel	Carbon Steel	reactor coolant water	0	Horizontal	High
G22.19		Crane	14	900	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	0	120 deg	Low
G22.20		Crane	14	900	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	0	120 deg	Low
G22.21		Powell	24	900	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	reactor coolant water	2	Vertical	High
G22.22		Crane	24	900	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	reactor coolant water	2	Vertical	High

Table 3-1: Gate Valve Test Matrix

JOG Test Matrix No	Reference	Manufacturer	Size (in)	Class (lb)	Disk Type	Disk Face Material	Seat Face Material	Disk Guide Face Material	Body Guide Face Material	Fluid	DP Strokes Per Year	Stem Orientation	As-Tested Valve Fac
G22.23		Anchor/Darling	18	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	reactor coolant water	0	20 deg	High
G27.01		Velan	6	150	Flexible Wedge	Stellite	Stellite	Carbon Steel	Carbon Steel	treated/closed loop water	4	Horizontal	High
G27.02	moved to G92.02												
G27.03	moved to G89.02												
G27.04		Velan	3	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	16	Vertical	High
G27.05		Anchor/Darling	3	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	feedwater	6	Horizontal	High
G27.06		Velan	6	150	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	4	45 deg	Low
G27.07		Anchor/Darling	12	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	4	Horizontal	High
G27.08		Walworth	3	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	12	Horizontal	High
G27.09		Anchor/Darling	4	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	reactor coolant water	<50	Vertical	Low/High
G27.10		Anchor/Darling	4	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	20	Vertical	High
G27.11		Anchor/Darling	4	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	20	Horizontal	Low
G27.12	moved to G22.17												
G27.13	replaced by G22.23												
G27.14		Velan	6	150	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	4	Horizontal	High
G27.15		Velan	12	150	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	8	Vertical	Low
G27.16		Anchor/Darling	4	600	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	21	105	High
G27.17		Powell	3	300	Solid Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	16	Horizontal	High
G27.18		Anchor/Darling	18	300	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	treated/closed loop water	10	Vertical	High
G32.01		Velan	6	150	Flexible Wedge	Stellite	Stellite	Stellite	Carbon steel	treated/closed loop water	2	Vertical	
G32.02		Velan	8	150	Flexible Wedge	Stellite	Stellite	Stellite	Carbon steel	treated/closed loop water	2	Vertical	
G32.03		Crane	16	300	Solid Wedge	Stellite	Stellite	Stellite	Carbon steel	treated/closed loop water	0	Horizontal	Low
G32.04		Velan	4	900	Flexible Wedge	Stellite	Stellite	Stellite	Carbon steel	feedwater	0	Vertical	
G32.05		Crane	16	300	Solid Wedge	Stellite	Stellite	Stellite	Carbon steel	treated/closed loop water	0	Horizontal	High
G36.01		Anchor/Darling	3	900	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	steam	2	Vertical	Low
G36.02	moved to G22.21												
G36.03	moved to G22.22												
G36.04	moved to G41.07												
G41.01	moved to G27.18												
G41.02		Powell	10	900	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	steam	12	Vertical	Low
G41.03	moved to G27.17												
G41.04		Anchor/Darling	8	600	Flexible Wedge	Stellite	Stellite	Carbon steel	Carbon steel	steam	12	Vertical	High
G41.06		Anchor/Darling	8	600	Flexible Wedge	Stellite	Stellite	Carbon Steel	Carbon Steel	steam	4	Horizontal	High
G41.07		Velan	4	600	Flexible Wedge	Stellite	Stellite	Carbon Steel	Carbon Steel	steam	12	Vertical	Low
G44.01	moved to G22.18												
G44.02		Walworth	4	900	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	treated/closed loop water	1	Vertical	Low
G44.03		Walworth	4	900	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	treated/closed loop water	1	Vertical	Low

Table 3-1: Gate Valve Test Matrix

JOG Test Matrix No	Reference	Manufacturer	Size (in)	Class (lb)	Disk Type	Disk Face Material	Seat Face Material	Disk Guide Face Material	Body Guide Face Material	Fluid	DP Strokes Per Year	Stem Orientation	As-Tested Valve Fac
G44.04		Powell	4	300	Solid Wedge	Stellite	Stellite	300 series SS	300 series SS	reactor coolant water	0	Horizontal	High
G44.05		Powell	4	300	Solid Wedge	Stellite	Stellite	300 series SS	300 series SS	reactor coolant water	0	Horizontal	High
G44.06		Powell	4	300	Solid Wedge	Stellite	Stellite	300 series SS	300 series SS	reactor coolant water	0	Horizontal	Low
G44.07		Walworth	24	600	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	treated/closed loop water	0	Vertical	Low
G44.08		Walworth	12	600	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	treated/closed loop water	0	Vertical	Low
G44.09		Anchor/Darling	6	900	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	feedwater	0	Vertical	High
G44.10		Anchor/Darling	6	900	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	feedwater	0	Vertical	High
G44.11		Anchor/Darling	6	900	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	feedwater	1	Vertical	High
G44.12		Anchor/Darling	6	900	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	feedwater	1	Vertical	High
G44.13		Anchor/Darling	6	900	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	feedwater	1	Vertical	High
G44.14		Anchor/Darling	6	900	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	feedwater	1	Vertical	High
G44.15		Anchor/Darling	8	150	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	reactor coolant water	0	Vertical	
G44.16	moved to G75.11												
G44.17		Anchor/Darling	4	900	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	reactor coolant water	0	Vertical	Low
G44.18		Aloyco	4	1500	Solid Wedge	Stellite	Stellite	300 series SS	300 series SS	reactor coolant	0	Vertical	Low
G49.01		Anchor/Darling	6	300	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	treated/closed loop water	5<X<10	Vertical	Low
G49.02		Anchor/Darling	6	300	Flexible Wedge	Stellite	Stellite	300 series SS	300 series SS	untreated water	12	45 deg	Low
G49.03	moved to G44.17												
G52.01	moved to G44.16												
G54.01		Anchor/Darling	3	1500	Double Disk	Stellite	Stellite			treated/closed loop water	0	Vertical	Low
G54.02		Anchor/Darling	6	150	Double Disk	Stellite	Stellite			treated/closed loop water	0	Vertical	Low
G54.03		Anchor Darling	3	1500	Double Disk	Stellite	Stellite			reactor coolant	0	Vertical	Low
G54.04		Anchor/Darling	4	900	Double Disk	Stellite	Stellite			reactor coolant water	0	Vertical	Low
G55.01		Anchor/Darling	4	1500	Double Disk	Stellite	Stellite			reactor coolant water	10	Vertical	Low
G56.01		Anchor/Darling	4	1500	Double Disk	Stellite	Stellite			reactor coolant water	0	Vertical	Low
G56.02		Anchor/Darling	6	150	Double Disk	Stellite	Stellite			treated/closed loop water	0	Vertical	Low
G56.03		Anchor/Darling	4	1500	Double Disk	Stellite	Stellite			reactor coolant water	0	Vertical	Low
G57.01		Anchor/Darling	6	300	Double Disk	Stellite	Stellite			treated/closed loop water	1.5	Horizontal	High
G57.02		Anchor/Darling	8	300	Double Disk	Stellite	Stellite			reactor coolant water	0	45 deg	High
G57.03		Anchor/Darling	8	300	Double Disk	Stellite	Stellite			reactor coolant water	0	Vertical	High
G58.01		Anchor/Darling	4	300	Double Disk	Stellite	Stellite			treated/closed loop water	4	Vertical	High
G58.02		Anchor/Darling	8	150	Double Disk	Stellite	Stellite			untreated water	6	Vertical	Low
G59.01		Anchor/Darling	4	900	Double Disk	Stellite	Stellite			feedwater	0	Horizontal	High
G59.02		Anchor/Darling	6	300	Double Disk	Stellite	Stellite			reactor coolant water	0	Horizontal	High
G60.01		Anchor/Darling	10	600	Double Disk	Stellite	Stellite			steam	10	Vertical	
G60.02		Anchor/Darling	4	900	Double Disk	Stellite	Stellite			steam	12	Vertical	Low
G60.03		Anchor/Darling	4	600	Double Disk	Stellite	Stellite			steam	6	Horizontal	High

Table 3-1: Gate Valve Test Matrix

JOG Test Matrix No	Reference	Manufacturer	Size (in)	Class (lb)	Disk Type	Disk Face Material	Seat Face Material	Disk Guide Face Material	Body Guide Face Material	Fluid	DP Strokes Per Year	Stem Orientation	As-Tested Valve Fac
G60.04		Anchor/Darling	10	900	Double Disk	Stellite	Stellite			steam	8	Vertical	High
G60.05		Anchor/Darling	4	600	Double Disk	Stellite	Stellite			steam	0	Horizontal	High
G60.06		Anchor/Darling	4	600	Double Disk	Stellite	Stellite			feedwater	12	75 deg	High
G63.01		Aloyco	6	150	Split Wedge	Stellite	Stellite	Stellite	300 series SS	treated/closed loop water	1.5	Vertical	Low
G63.02		Aloyco	6	300	Split Wedge	Stellite	Stellite			reactor coolant water	1	Horizontal	Low
G63.03		Crane-Aloyco	8	300	Split Wedge	Stellite	Stellite	300 series SS	300 series SS	reactor coolant water	0	Vertical	Low
G63.04		Aloyco	6	150	Split Wedge	Stellite	Stellite		300 series SS	reactor coolant water	0	Vertical	High
G63.05		Crane-Aloyco	6	300	Split Wedge	Stellite	Stellite			reactor coolant water	0	Vertical	Low
G63.06		Crane-Aloyco	6	300	Split Wedge	Stellite	Stellite			reactor coolant water	0	Vertical	Low
G65.01		Aloyco	8	150	Split Wedge	Stellite	Stellite	300 series SS	Stellite	treated/closed loop water	0	Vertical	High
G65.02		Crane-Aloyco	8	300	Split Wedge	Stellite	Stellite	300 series SS	300 series SS	reactor coolant water	0		High
G65.03	replaced by G65.03												
G69.01		Westinghouse	8	316	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	treated/closed loop water	0	45 deg	Low
G69.02		Westinghouse	6	150	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	treated/closed loop water	0	Vertical	Low
G69.03		Westinghouse	3	1500	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	reactor coolant water	1	Vertical	High
G69.04		Westinghouse	3	2035	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	reactor coolant water	1	Vertical	Low
G69.05		Velan	4	1500	Flexible Wedge	Stellite	Stellite	Stellite	Stellite	reactor coolant water	0	Vertical	Low
G69.06		Westinghouse	6	900	Flexible Wedge	Stellite	Stellite	Stellite	17-4PH	reactor coolant water	0.7	Vertical	High
G69.07		Westinghouse	3	2035	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	reactor coolant water	0	Vertical	Low
G69.08		Velan	12	300	Flexible Wedge	Stellite	Stellite	Stellite	300 series SS	reactor coolant water	0	Vertical	Low
G69.09		Velan	6	1500	Flexible Wedge	Stellite	Stellite	Stellite	300 series SS	reactor coolant water	0	Vertical	Low
G69.10		Velan	3	1500	Flexible Wedge	Stellite	Stellite	Stellite	300 series SS	reactor coolant water	0	Vertical	Low
G69.11		Velan	3	1500	Flexible Wedge	Stellite	Stellite	Stellite	300 series SS	reactor coolant water	0	Vertical	Low
G69.12		Westinghouse	10	300	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	treated/closed loop water	0	Vertical	Low
G69.13		Anchor/Darling	12	900	Flexible Wedge	Stellite	Stellite	Stellite	Carbon steel	reactor coolant water	0	Vertical	Low
G69.14		Velan	16	150	Flexible Wedge	Stellite	Stellite	Stellite	Carbon steel	treated/closed loop water	0	Horizontal	Low
G69.15		Westinghouse	4	1525	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	reactor coolant	0	Vertical	Low
G73.01	moved to G69.12												
G73.02		Velan	4	1500	Flexible Wedge	Stellite	Stellite	Stellite	300 series SS	reactor coolant water	10	Vertical	High
G75.01		Westinghouse	8	1525	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	treated/closed loop water	0	Vertical	High
G75.02		Westinghouse	8	316	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	treated/closed loop water	0	45 deg	Low
G75.03		Westinghouse	4	900	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	treated/closed loop water	0	Vertical	High
G75.04		Westinghouse	3	2035	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	reactor coolant water	1	Vertical	High
G75.06		Westinghouse	6	1525	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	reactor coolant water	0.7	Vertical	High
G75.07		Westinghouse	6	150	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	treated/closed loop water	1	Vertical	High
G75.08		Velan	12	300	Flexible Wedge	Stellite	Stellite	Stellite	300 series SS	reactor coolant water	0	Vertical	High
G75.09		Westinghouse	3	2035	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	reactor coolant	0	Vertical	High

Table 3-1: Gate Valve Test Matrix

JOG Test Matrix No	Reference	Manufacturer	Size (in)	Class (lb)	Disk Type	Disk Face Material	Seat Face Material	Disk Guide Face Material	Body Guide Face Material	Fluid	DP Strokes Per Year	Stem Orientation	As-Tested Valve Fac
G75.10		Velan	16	150	Flexible Wedge	Stellite	Stellite	Stellite	Carbon steel	treated/closed loop water	0	Horizontal	High
G75.11		Velan	14	900	Flexible Wedge	Stellite	Stellite	Stellite	300 series SS	reactor coolant water	0	Horizontal	High
G79.01	moved to G69.13												
G79.02		Westinghouse	12	1525	Flexible Wedge	Stellite	Stellite	Stellite	17-4 PH	hot water	0	Vertical	High
G81.01		Ring-O	8	900	Flexible Wedge	Stellite	Stellite	Stellite	Stellite	steam	5<X<10	Vertical	High
G83.01		Borg-Warner	3	1500	Flexible Wedge	Stellite	Stellite	300 series SS	17-4 PH	treated/closed loop water	0	Horizontal	Low
G83.02		Borg-Warner	4	1500	Flexible Wedge	Stellite	Stellite	300 series SS	17-4 PH	treated/closed loop water	1	Horizontal	Low
G83.03		Borg-Warner	4	900	Flexible Wedge	Stellite	Stellite	316 Stainless Steel	17-4 PH	feedwater	0	Vertical	High
G84.01	moved to G83.03												
G85.01		Borg-Warner	4	1500	Flexible Wedge	Stellite	Stellite	300 series SS	17-4 PH	hot water	1	Horizontal	High
G88.01		Powell	8	150	Solid Wedge	13Cr	13Cr	Carbon steel	Carbon steel	treated/closed loop water	0	Horizontal	High
G88.02	moved to G89.03												
G88.03		Powell	12	150	Solid Wedge	13Cr	13Cr	300 series SS	Carbon Steel	untreated water	2.5	Vertical	High
G89.01		Powell	8	150	Solid Wedge	13Cr	13Cr	Stainless Steel	Carbon steel	untreated water/treated	10	Vertical	Low
G89.02		Powell	4	300	Solid Wedge	13Cr	13Cr	13Cr	Carbon steel	treated/closed loop water	16	Vertical	Low
G89.03		Walworth	12	150	Solid Wedge	13Cr	13Cr	Carbon steel	Carbon steel	untreated water	4	Horizontal	
G90.01	moved from progra												
G91.01	moved to G22.19												
G91.02	moved to G22.20												
G91.03		Powell	4	150	Flexible Wedge	13Cr	Stellite	13Cr	Carbon Steel	treated/closed loop water	<2	Horizontal	High
G91.04	replaced by G32.05												
G91.05		Powell	6	150	Solid Wedge	13Cr	Stellite	Carbon steel	Carbon steel	treated/closed loop water	0	Vertical	
G91.06		Crane	18	300	Double Disk	13Cr	Stellite	Carbon Steel	Carbon steel	feedwater	0	Vertical	Low
G92.01		Powell	18	300	Flexible Wedge	13Cr	Stellite	Carbon steel	Carbon steel	reactor coolant water	12 - 15	Horizontal	High
G92.02		Walworth	18	300	Solid Wedge	13Cr	Stellite	Carbon steel	Carbon steel	treated/closed loop water	4	Horizontal	Low
G92.03		Powell	3	900	Solid Wedge	13Cr	Stellite	Carbon steel	Carbon steel	feedwater	6	Vertical	High
G96.01		Crane	16	900	Flexible Wedge	Stellite	Stellite	Stellite	Malcolmized type 410	treated/closed loop water	0	70 deg	High
G96.02		Crane	16	900	Flexible Wedge	Stellite	Stellite	Stellite	Malcolmized type 410	treated/closed loop water	0	70 deg	Low
G98.01		Anchor/Darling	16	300	Double Disk	Deloro 50	Deloro 50			treated/closed loop water	0	Horizontal	Low
G99.01		Crane	3	300	Solid Wedge	410 Stainless St	Monel	Carbon steel	Carbon steel	treated/closed loop water	12	Vertical	High
G99.02		Crane	3	300	Solid Wedge	410 Stainless St	Monel	Carbon steel	Carbon steel	treated/closed loop water	12	Vertical	High
G99.03		Crane	6	600	Solid Wedge	Exelloy	Monel	300 series SS	Carbon steel	treated/closed loop water	0	Horizontal	Low
G99.04		Crane	6	600	Solid Wedge	Exelloy	Monel	300 series SS	Carbon steel	treated/closed loop water	0	Horizontal	High
G99.05		Crane	6	600	Solid Wedge	Exelloy	Monel	300 series SS	Carbon steel	treated/closed loop water	0	Horizontal	High
G99.06		Pacific	6	150	Flexible Wedge	12Cr	Monel	Carbon steel	Carbon steel	treated/closed loop water	0	Vertical	High
G99.07		Walworth	8	150	Solid Wedge	410 Stainless St	Monel	Carbon steel	Carbon steel	treated/closed loop water	1	Horizontal	Low

Table 3-2: Butterfly Valve Test Matrix

JOG Test Matrix No.	Reference	Manufacturer	Size (in)	Bearing Material	Fluid	Total Strokes Per Year	DP Strokes Per Year	Stem Orientation	Normal Position
B01.1		Clow	10	Bronze	untreated water	10	10	Horizontal	Open
B01.2		Clow	10	Bronze	untreated water	10	10	Horizontal	Open
B03.1	moved to B16.3								
B03.2		Clow	20	Bronze	untreated water	1	1	Horizontal	Open
B05.1	moved to B25.3								
B06.1		Crane/Flowseal	6	Bronze	untreated water	2	0	Vertical	Open
B07.1		Henry Pratt	30	Bronze	untreated water	8	8	Horizontal	Closed
B08.1		Contromatics	14	Bronze	untreated water	4	1	Horizontal	Closed
B09.1		ACE	20	Bronze/Graphite	untreated water	40	15	Vertical	Closed
B09.2		Henry Pratt	6	Bronze	untreated water	12	12	Vertical	Closed
B09.3		Henry Pratt	6	Bronze	untreated water	12	12	Vertical	Closed
B09.4		Henry Pratt	6	Bronze	untreated water	12	12	Vertical	Closed
B09.5		Henry Pratt	6	Bronze	untreated water	12	12	Vertical	Closed
B10.1	replaced by B09.2								
B10.2	moved to B08.1								
B11.1		Contromatics	10	Bronze	treated/closed loop water	20	10	Horizontal	Open
B12.1		Fisher Controls	8	Bronze/Graphite	treated/closed loop water	4	2	Horizontal	Open
B12.2	replaced by G60.06								
B13.1		Contramatics	10	Bronze	treated/closed loop water	10	10	Vertical	Open
B15.1		Henry Pratt	14	Bronze	treated/closed loop water	2	0	Vertical	Closed
B16.1		Henry Pratt	24	Fiberglass/Teflon	untreated water	16	12	Vertical	Closed
B16.2		Pratt	96	Fiberglass/Teflon	untreated water	12.3	12.3	Vertical	Open
B16.3		Henry Pratt	18	Nylatron	untreated water	4	4	Vertical	Open
B20.1		Henry Pratt	24	Fiberglass/Teflon	untreated water	2	2	Horizontal	Closed
B22.1		Henry Pratt	10	Fiberglass/Teflon	treated/closed loop water	8	8	Vertical	Open
B22.2		Henry Pratt	10	Fiberglass/Teflon	treated/closed loop water	8	8	Vertical	Open
B22.3		Jamesbury	16	Fiberglass/Teflon	treated/closed loop water	50	50	Vertical	Open
B22.4		Hills-Mccanna	16	Tefzel	treated/closed loop water	4	4	Vertical	Open
B24.1	moved to B22.4								
B24.2		Henry Pratt	24	Nylon	treated/closed loop water	6	0	Vertical	Open
B25.1	replaced by B09.3								
B25.2	replaced by G57.03								
B25.3		Allis-Chalmers	24	SS/Teflon	untreated water	5.5	5.5	Vertical	Open
B28.1	replaced by B09.4								
B29.1	replaced by B24.2								
B30.1	replaced by B09.5								
B30.2		Henry Pratt	12	SS/Teflon	treated/closed loop water	6	0	Vertical	Open
B30.3		Jamesbury	12	SS/Polyethylene	treated/closed loop water	6	0	Vertical	Open
B30.4	moved to B29.1								

Table 3-3: Balanced Disk Globe Valve Test Matrix

JOG Test Matrix No	Manufacturer	Reference	Size (in)	Class (lb)	Disk Guide Material	Body Guide Material	Fluid	DP Strokes Per Year
BG01.1	Fisher Controls		4	900	Stellite	17-4 PH	feedwater	75
BG02.1		moved to BG01.1						
BG05.1	Fisher Controls		4	300	300 series Stainless Steel	400 series Stainless Steel	treated/closed loop water	6
BG05.2								
BG06.1	Copes-Vulcan		10	150	400 series Stainless Steel	400 series Stainless Steel	untreated water	1
BG06.2	CCI		8	300	410 Stainless Steel	300 series Stainless Steel	reactor coolant water	2
BG07.1	Valtek		10	900	316 Stainless Steel	Bronze	feedwater	4
BG08.1	CCI		2	900	410 Stainless Steel	Carbon steel	feedwater	0
BG10.1	Copes-Vulcan		12	150	17-4 PH	Stainless Steel	untreated water	4
BG10.2	Copes-Vulcan		16	150	17-4 PH	Stainless Steel	untreated water	4

Table 3-4: Unbalanced Disk Globe Valve Test Matrix

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JOG Test Matrix	Manufacturer	Size (in)	Class (lb)	Fluid
UG01	Valtek	16	300	feedwater
UG02	Fisher Controls	6	300	untreated water
UG03	Powell	4	600	feedwater
UG04	Anchor/Darling	18	300	reactor coolant water
UG05				
UG06				
UG07	Walworth	4	600	steam
UG08	Velan	2	1500	reactor coolant water
UG09	Anchor/Darling	18	300	suppression pool
UG10	Velan	2	1500	reactor coolant water
UG11	Velan	2	1500	reactor coolant water
UG12	Velan	2	1500	treated/closed loop water
UG13	Walworth	4	600	steam
UG14	Powell	3	600	steam