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

Status Update

JOG-NRC Meeting

October 17, 2001

JOG PV Program Participation

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

- 197 Test MOVs
  - 149 Gate Valves
  - 28 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 10/1/01)

Test Sequence	Tests Scheduled	Tests Performed	% of Scheduled Tests Performed	Test Packages Due	Test Packages Submitted	% of Due Test Packages Submitted
Baseline	196	194	99%	194	189	97%
Second	179	177	99%	167	148	89%
Third	63	68	108%	62	54	87%
TOTAL	**438**	**439**	**100%**	**423**	**391**	**92%**
LAST MTG	**398**	**373**	**94%**	**325**	**319**	**98%**

Summary of Valves Tested vs Valves Untested

	Baseline	Second	Third	Cumulative
Tested Valves	194	177	68	439
Untested	3	20	129	152
% Tested	**98%**	**90%**	**35%**	**74%**

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Testing Progress (cont'd)

- End of testing scheduled for October 2002
- Some third tests to be completed after 10/2002
  - More valves in program than originally planned
  - Attrition lower than expected
  - Impact of tests beyond 10/2002 evaluated -- expect to have adequate data to draw program conclusions
- **5 plants have completed JOG testing with all test packages approved**

Key Observations

Gate Valves

- Disassembly/reassembly is the dominant influence. VFs of disassembled valves tend to be reduced and tend to increase during service (FN-03).
- Some non-disassembled valves with initial low VFs show increases to average values.
- Non-disassembled valves with initial high VFs do not show increases.
- Exceptions
  - 1 valve (non-stellite seats) showed increase from high initial VF. Data has been re-analyzed and are no longer an exception.

Key Observations (cont'd)

Gate Valves (cont'd)

- Exceptions
  - 2 valves (cold water, low strokes) show increase from high initial VF. Additional analysis and discussions with plant underway.
  - 1 valve (hot water) shows increase in second test from high initial VF (close only); behavior stabilizes in third test.

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 - no trend has been identified

Balanced Disk Globe Valves

- Low valve factors and no degradation

Unbalanced Disk Globe Valves

- Small changes in VF, but no evidence of degradation

Feedback to Program Participants

- No new Feedback Notices since last meeting
- 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

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	85	27
Butterfly	11	3
Balanced Globe	7	3
Unbalanced Globe	5	3

Gate Valve Test Results

- General Observations for Gate Valves
  - Valve disassembly/reassembly is the dominant influence on changes in VF
    - VFs following disassembly tend to be reduced and tend to increase to values similar to non-disassembled valves
    - VF plateau may not occur by second test
  - For valves not disassembled, initial VF tends to influence changes in VF
    - some low initial VFs increase to average values
    - high initial VFs tend to be stable or decrease with stroking

Gate Valve Test Results (cont'd)

- General Observations for Gate Valves (cont'd)
  - Exceptions for non-disassembled valves
    - G91.05 (13Cr/Stellite seats): high initial VFs show an increase. Further data analysis indicates valve performance is similar to other valves and stable VFs.
    - G79.02 (hot water): high initial VFs show an increase in second test (closing only). Behavior stabilizes in third test (mod to actuator may influence baseline to second test comparison)
    - G44.04 & G75.01 (cold water, no strokes): high initial VFs show an increase in close strokes. Further analysis and discussions with plant underway.

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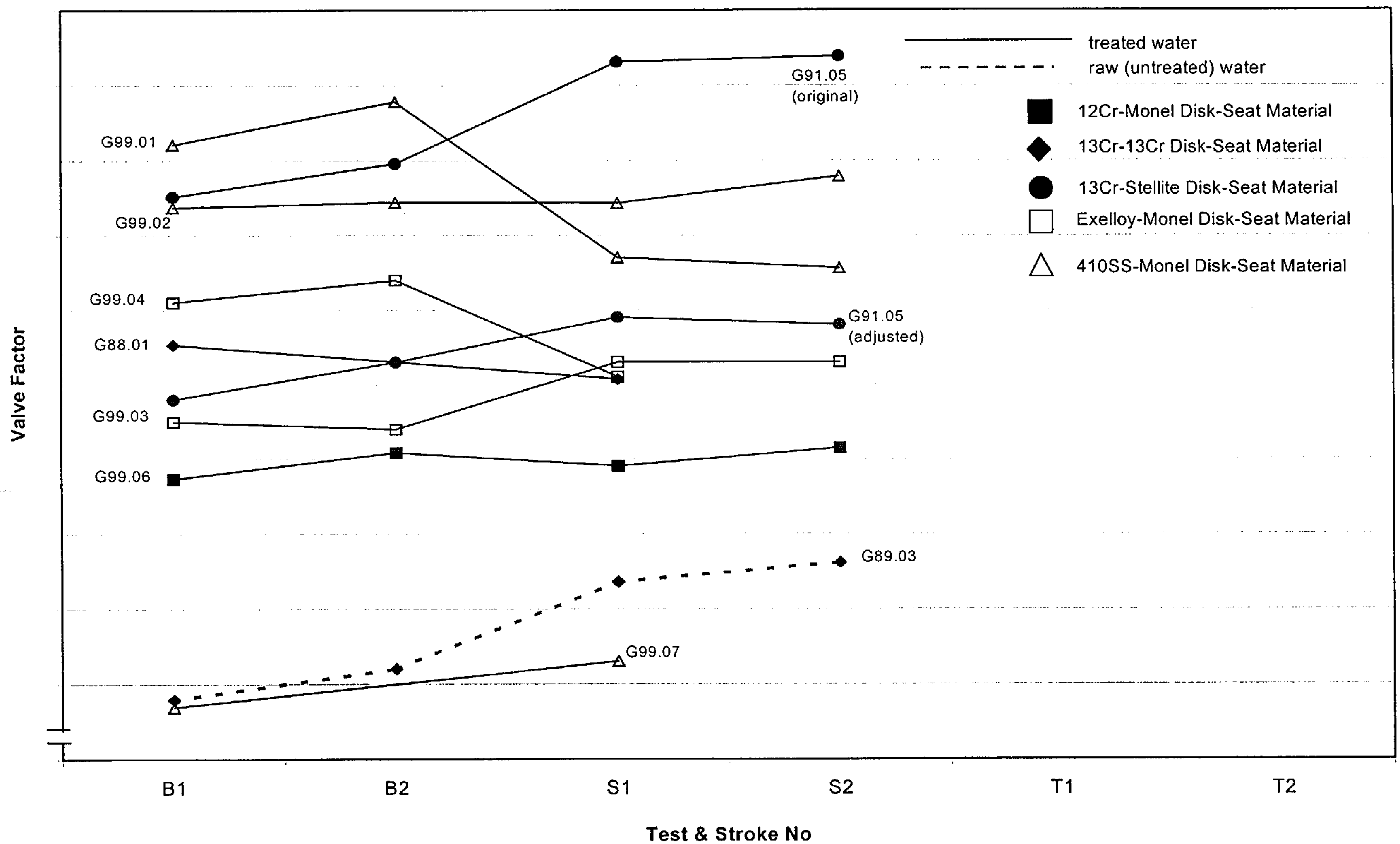
Gate Valve Test Results (cont'd)

- 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
  - high/low DP stroking
  - valve disassembly
  - guide material pair

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



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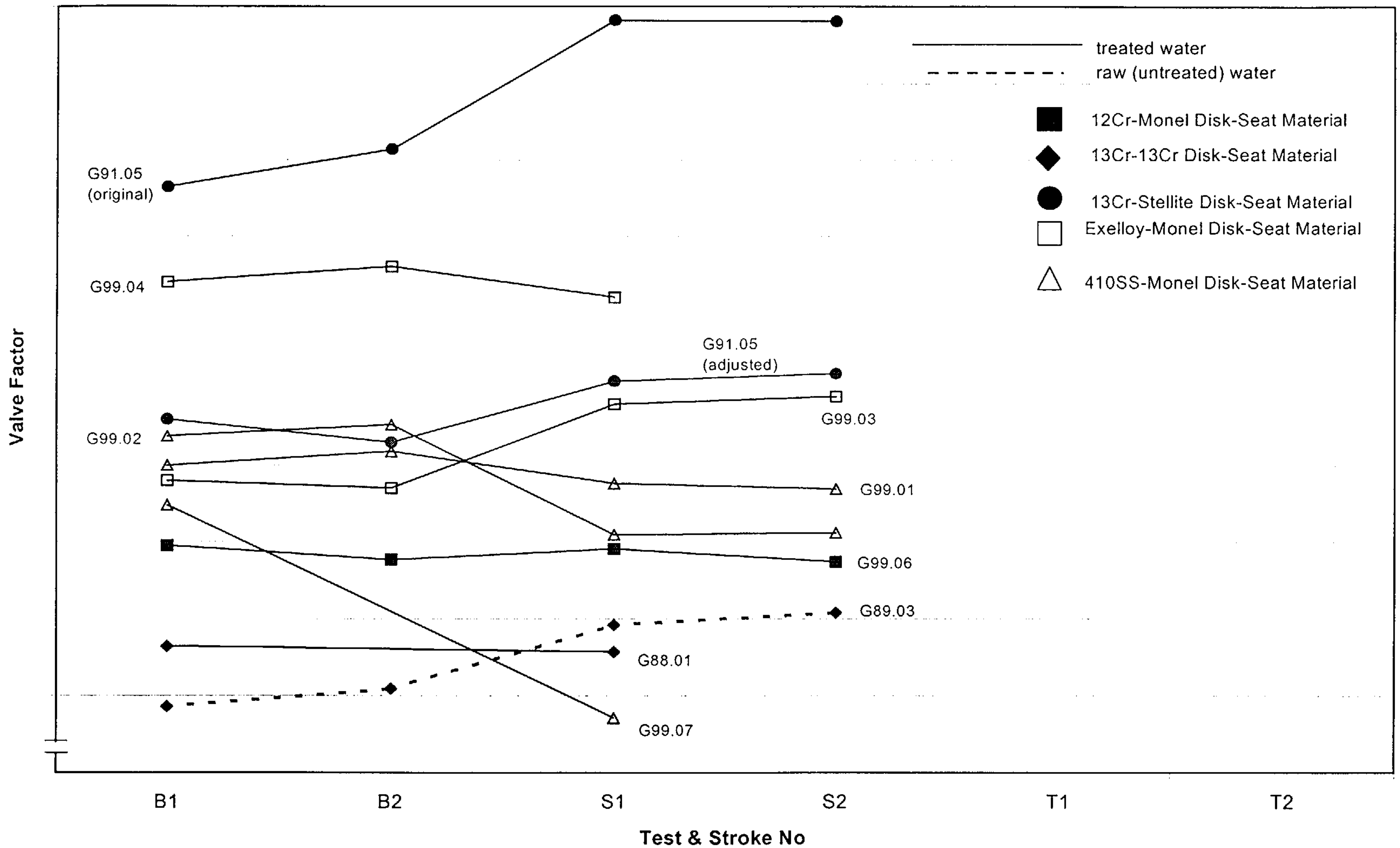
Progression of Opening Valve Factors at Flow Initiation - Non-Stellite Seat Pairs



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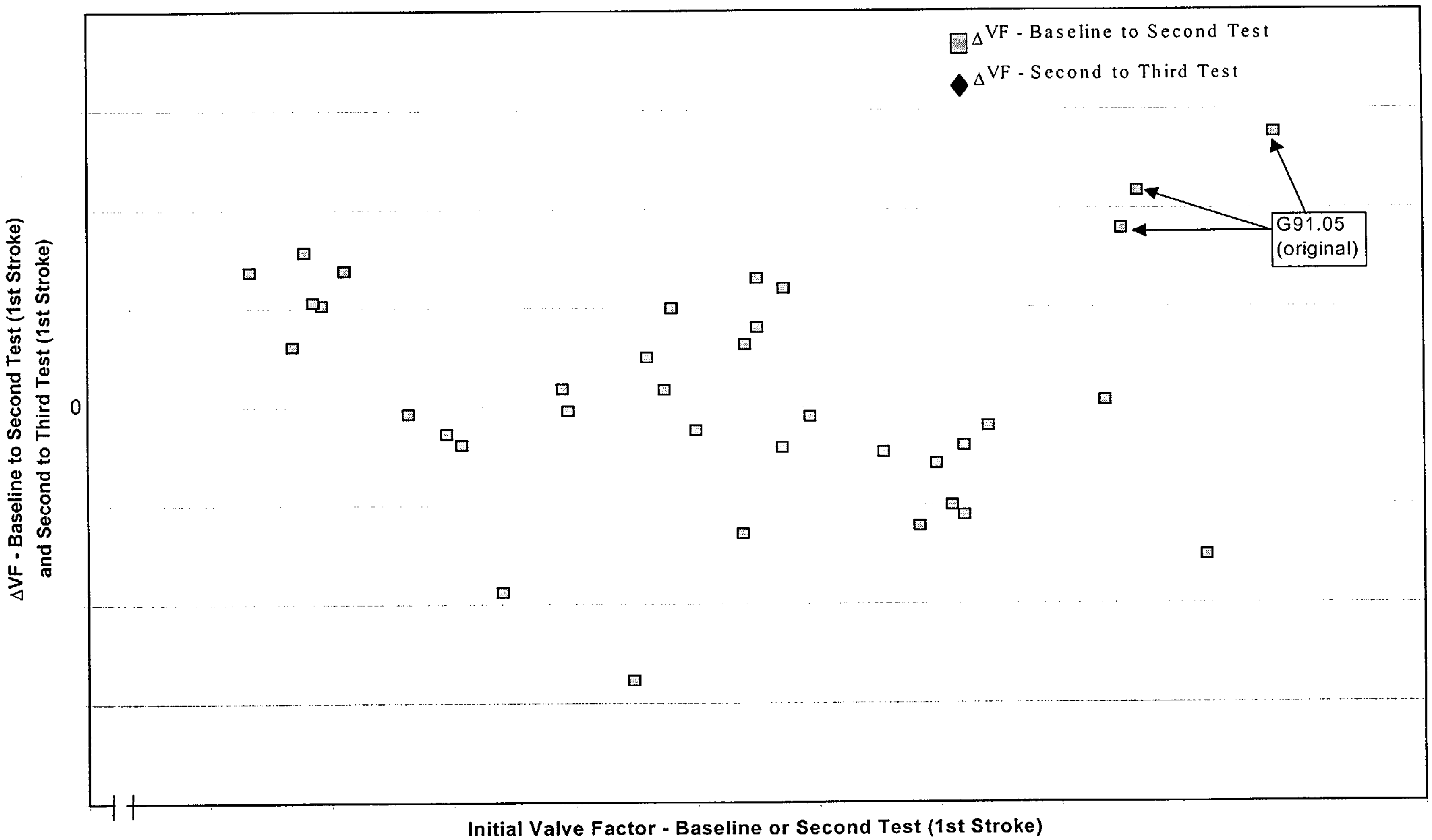
ΔValve Factor vs Initial Valve Factor - Non-Stellite Seat Pairs



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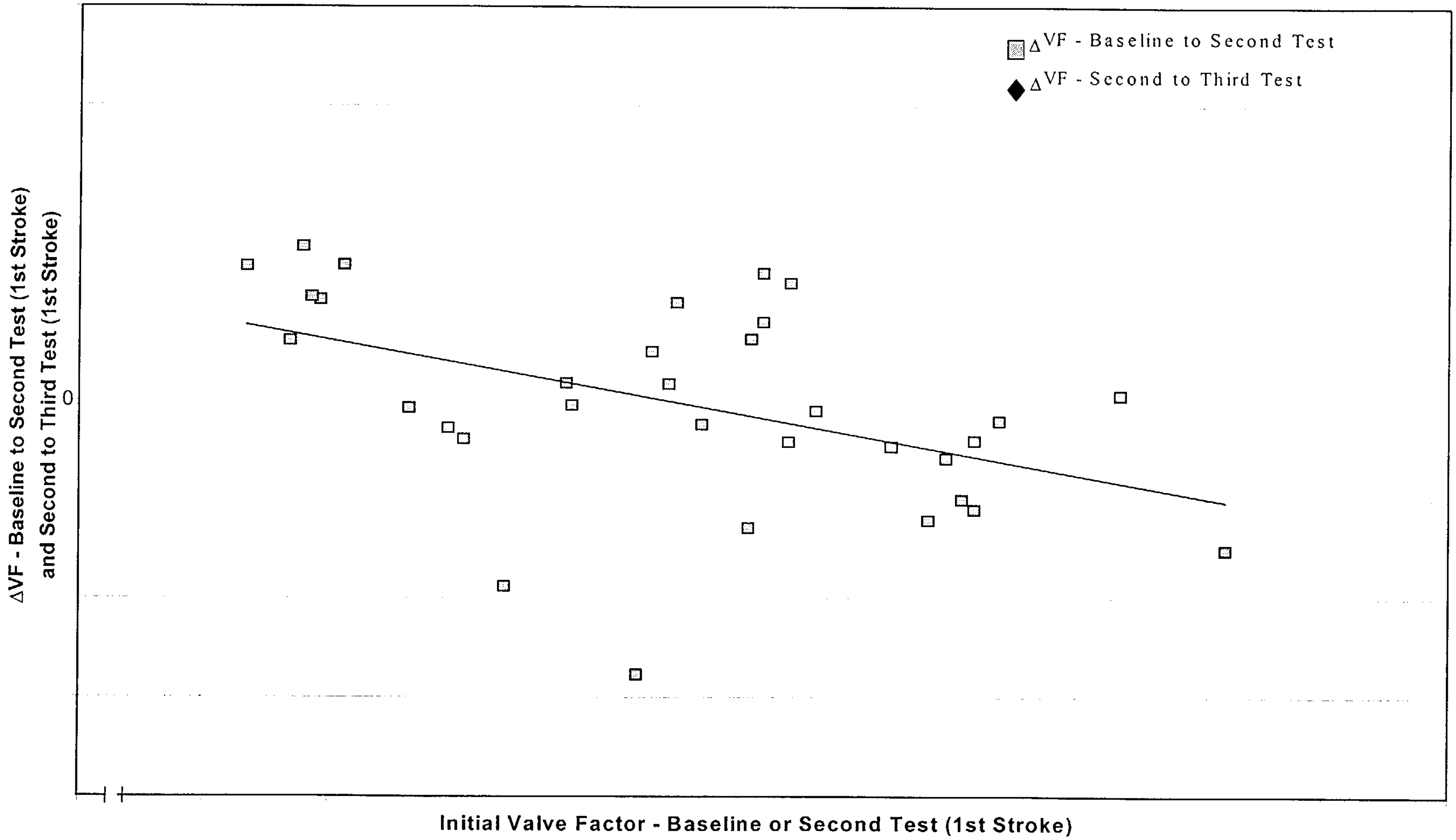
ΔValve Factor vs Initial Valve Factor - Non-Stellite Seat Pairs (outliers removed)



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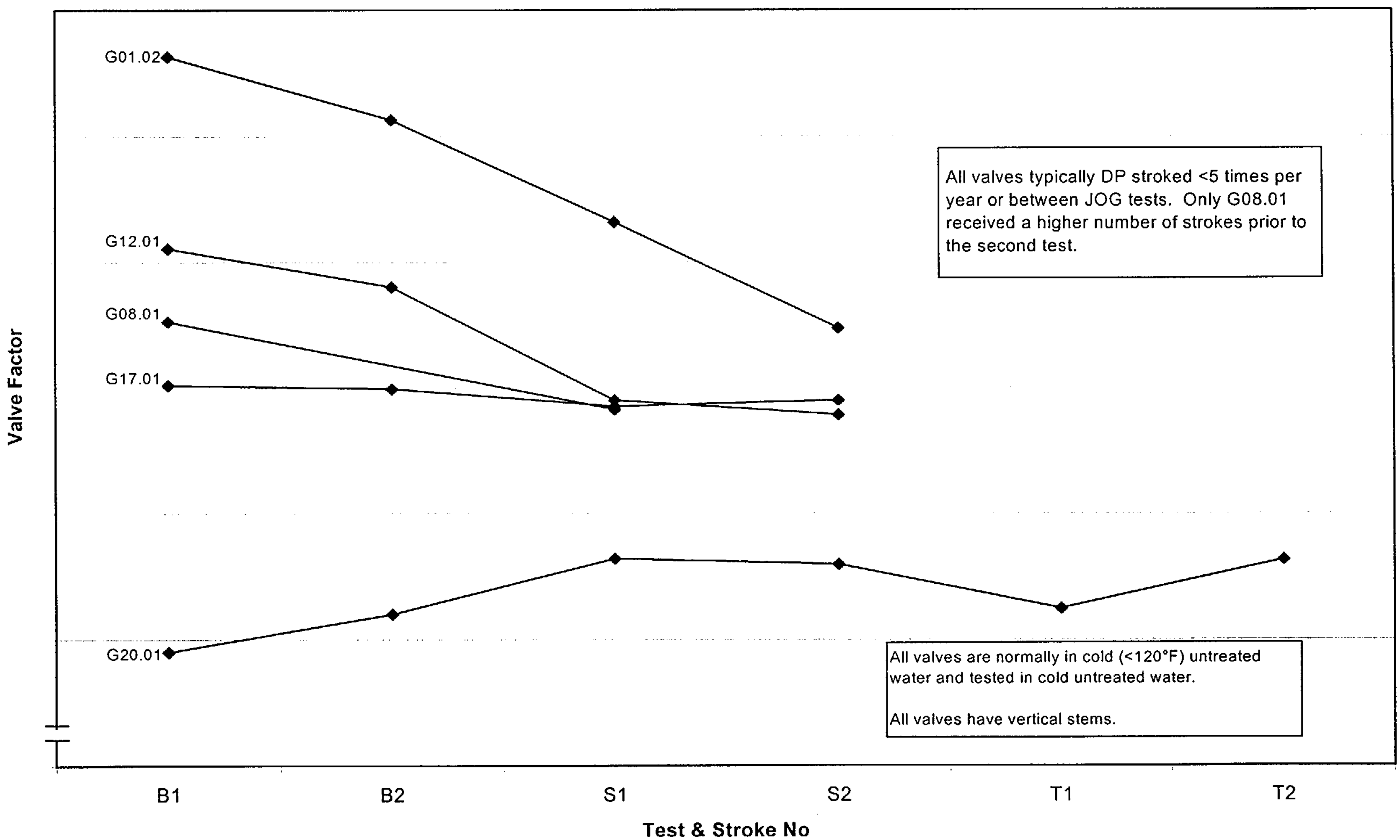
Progression of Closing Valve Factors at Initial Wedging - Stellite Seats/Untreated Water



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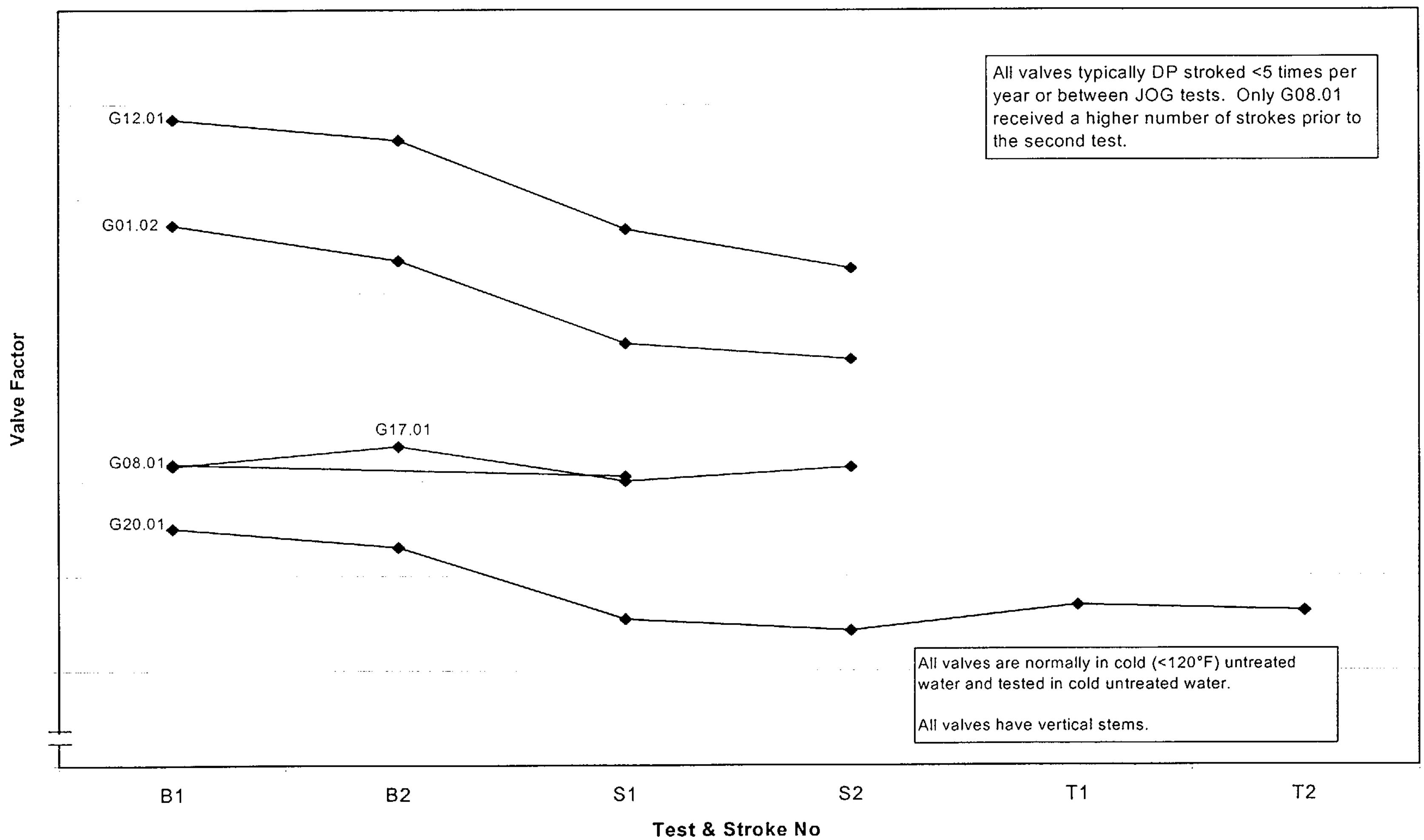
Progression of Opening Valve Factors at Flow Initiation - Stellite Seats/Untreated Water



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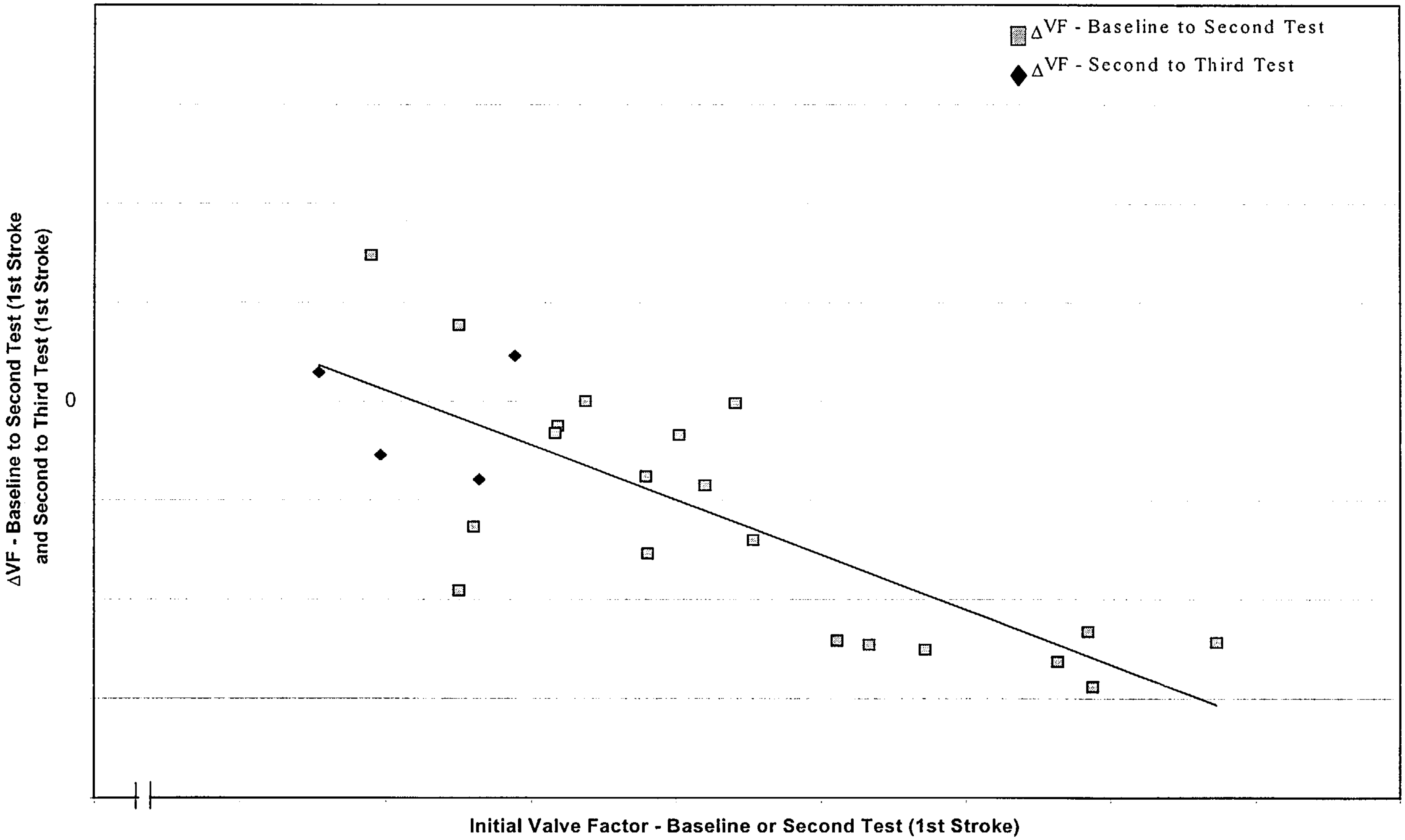

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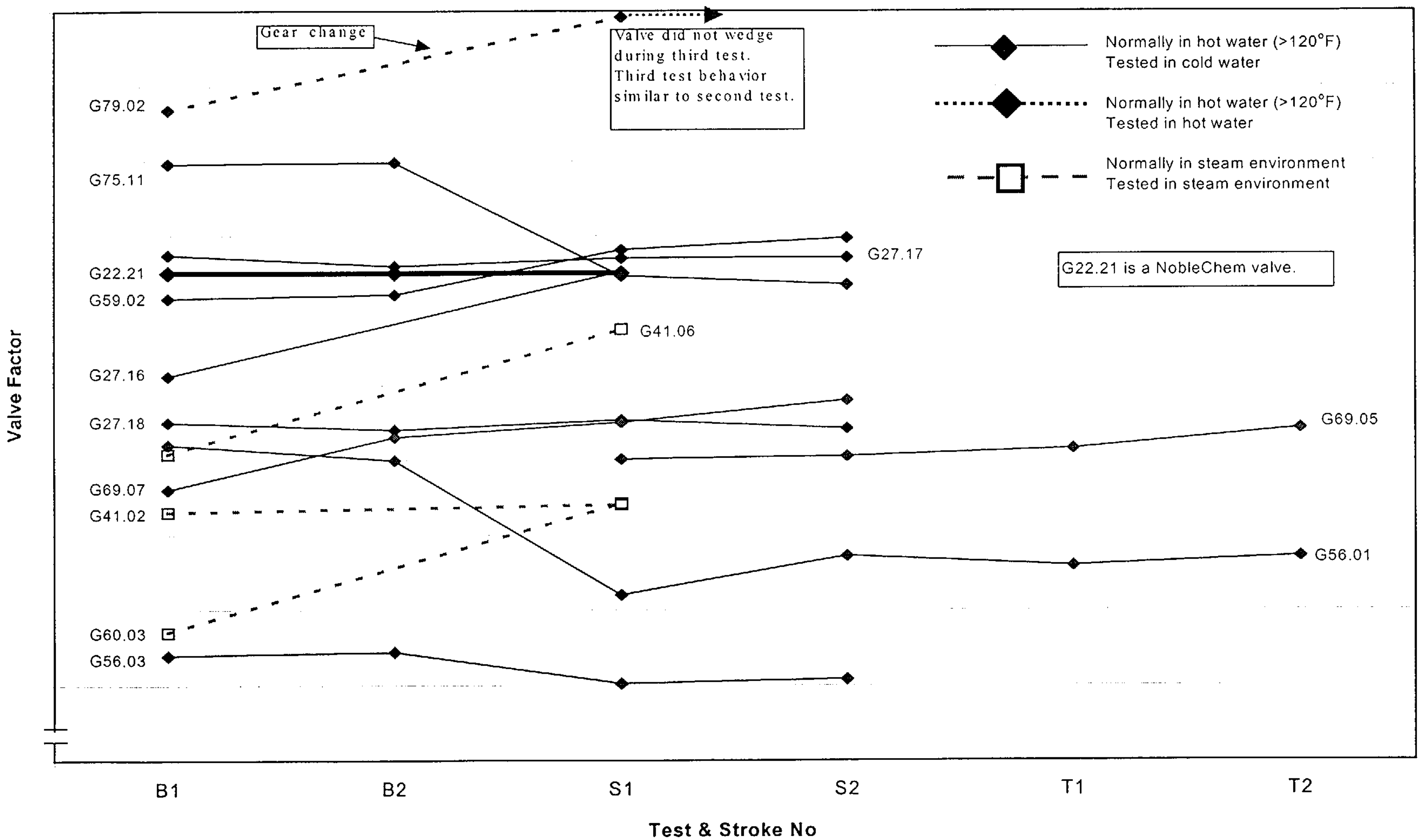
Progression of Closing Valve Factor at Initial Wedging - Stellite Seats/ Hot Water/Steam - No Internal Maintenance Prior to Baseline Test



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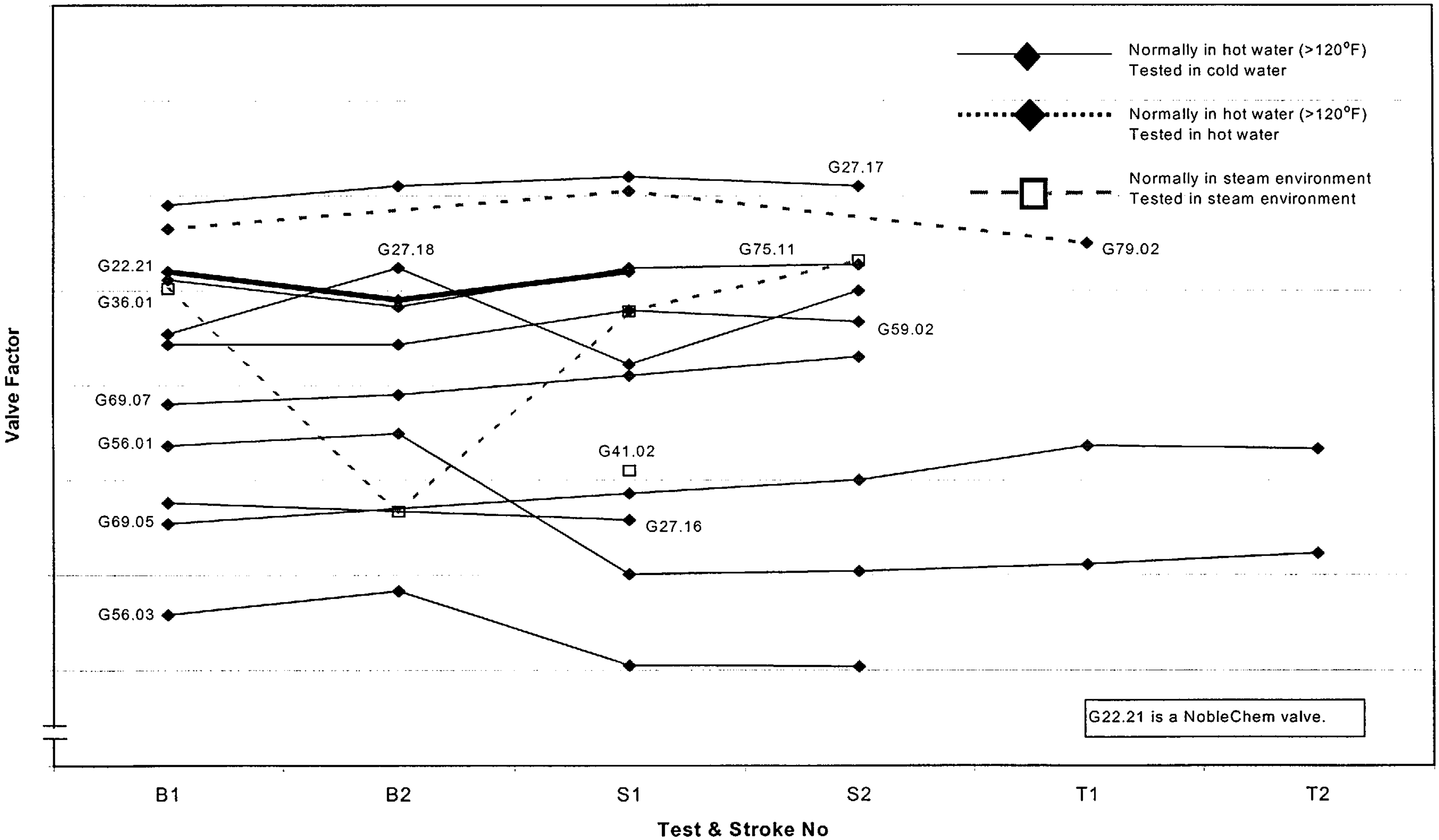

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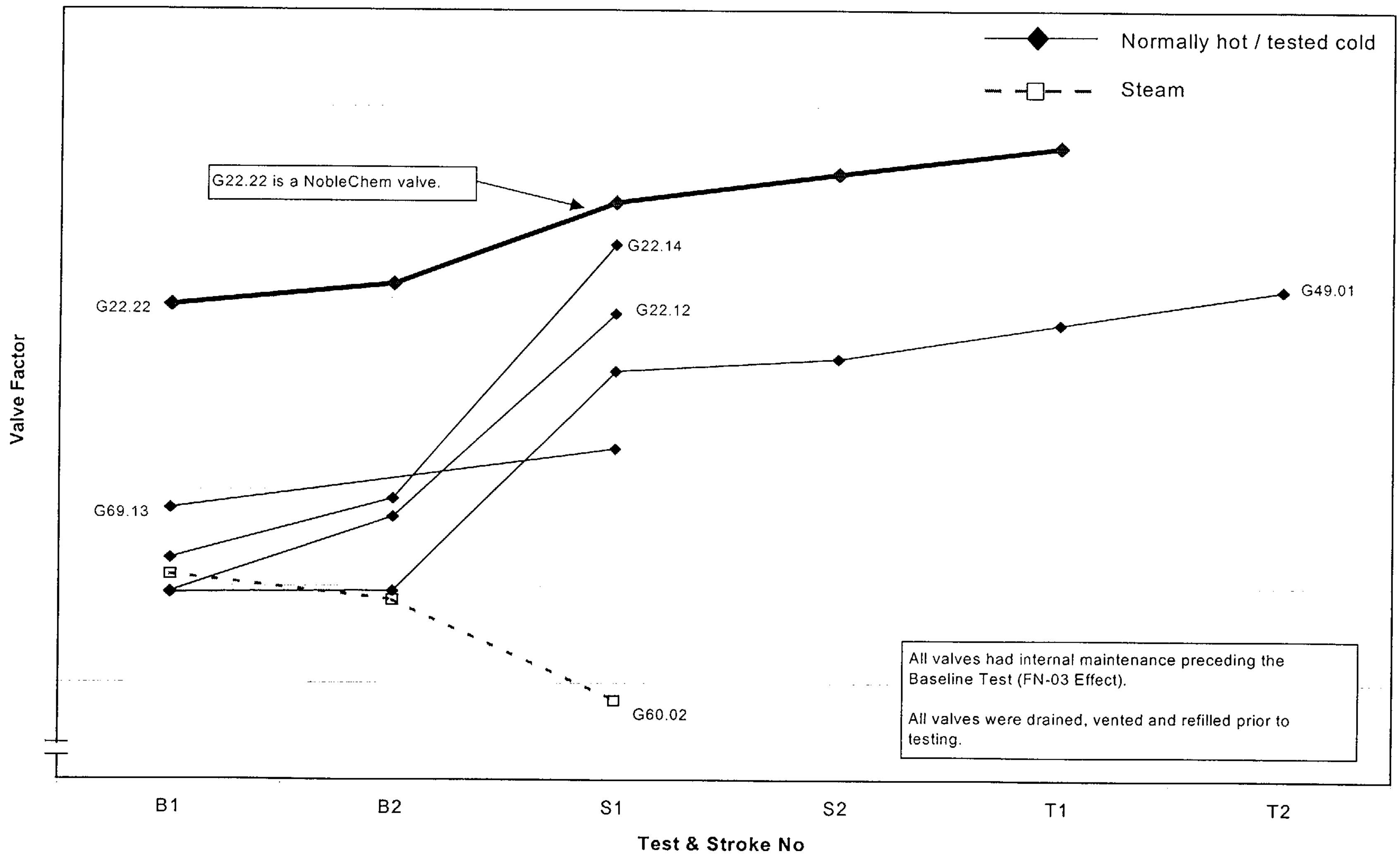
Progression of Closing Valve Factor at Initial Wedging - Stellite Seats/ Hot Water/Steam - Internal Maintenance Prior to Baseline Test (FN-03 Effect)



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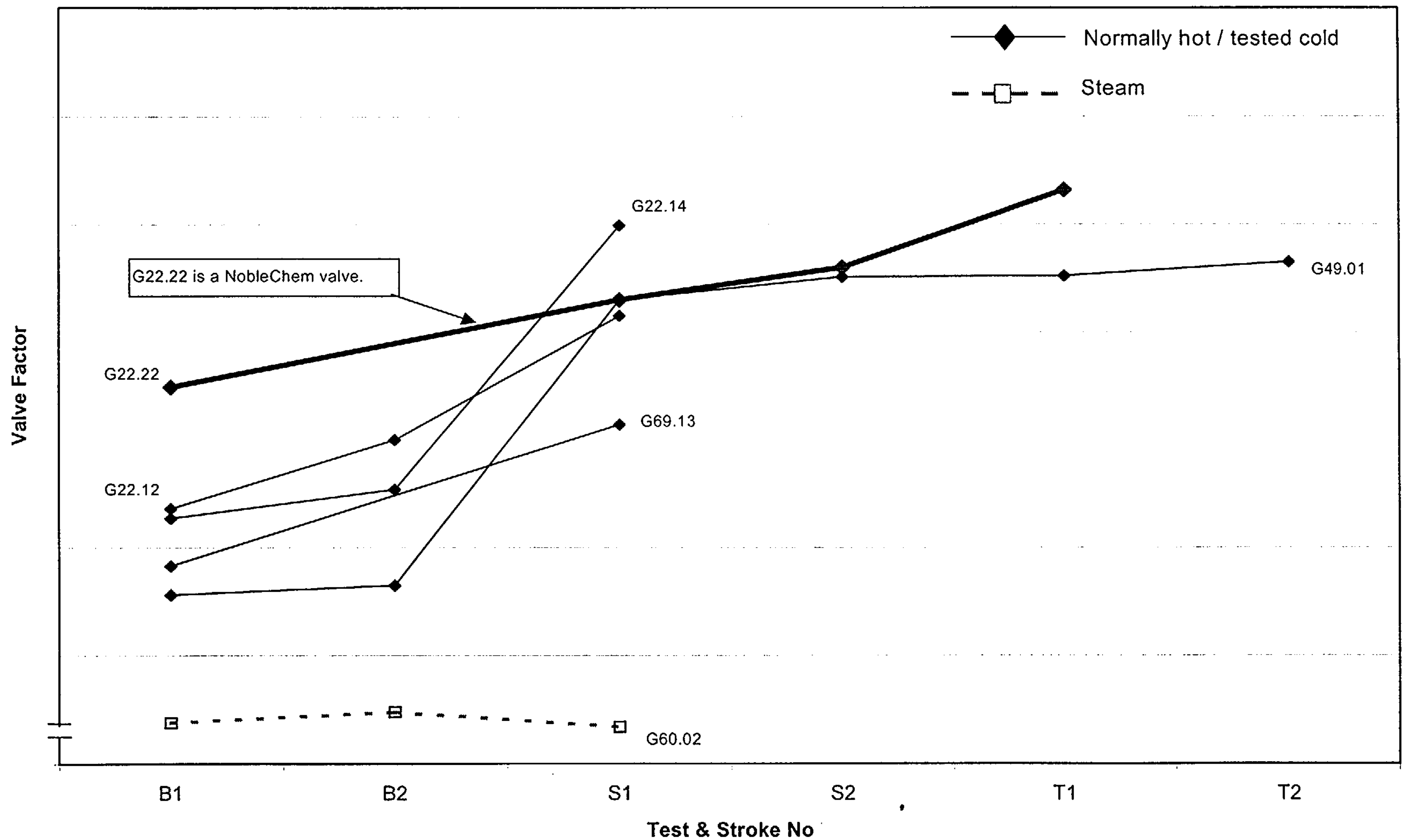

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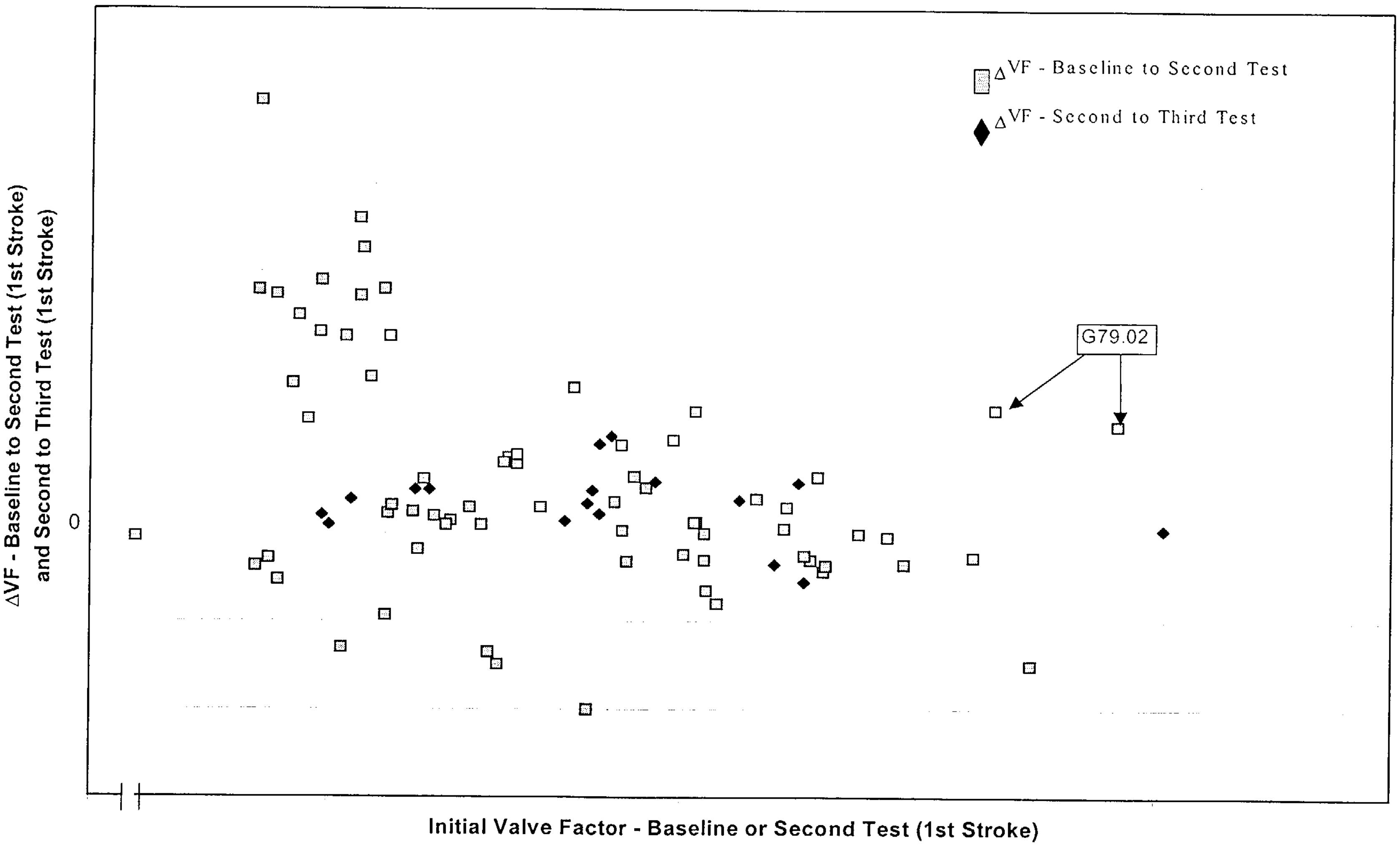
ΔValve Factor vs Initial Valve Factor - All Gate Valves in Stellite Seats/ Hot Water/Steam



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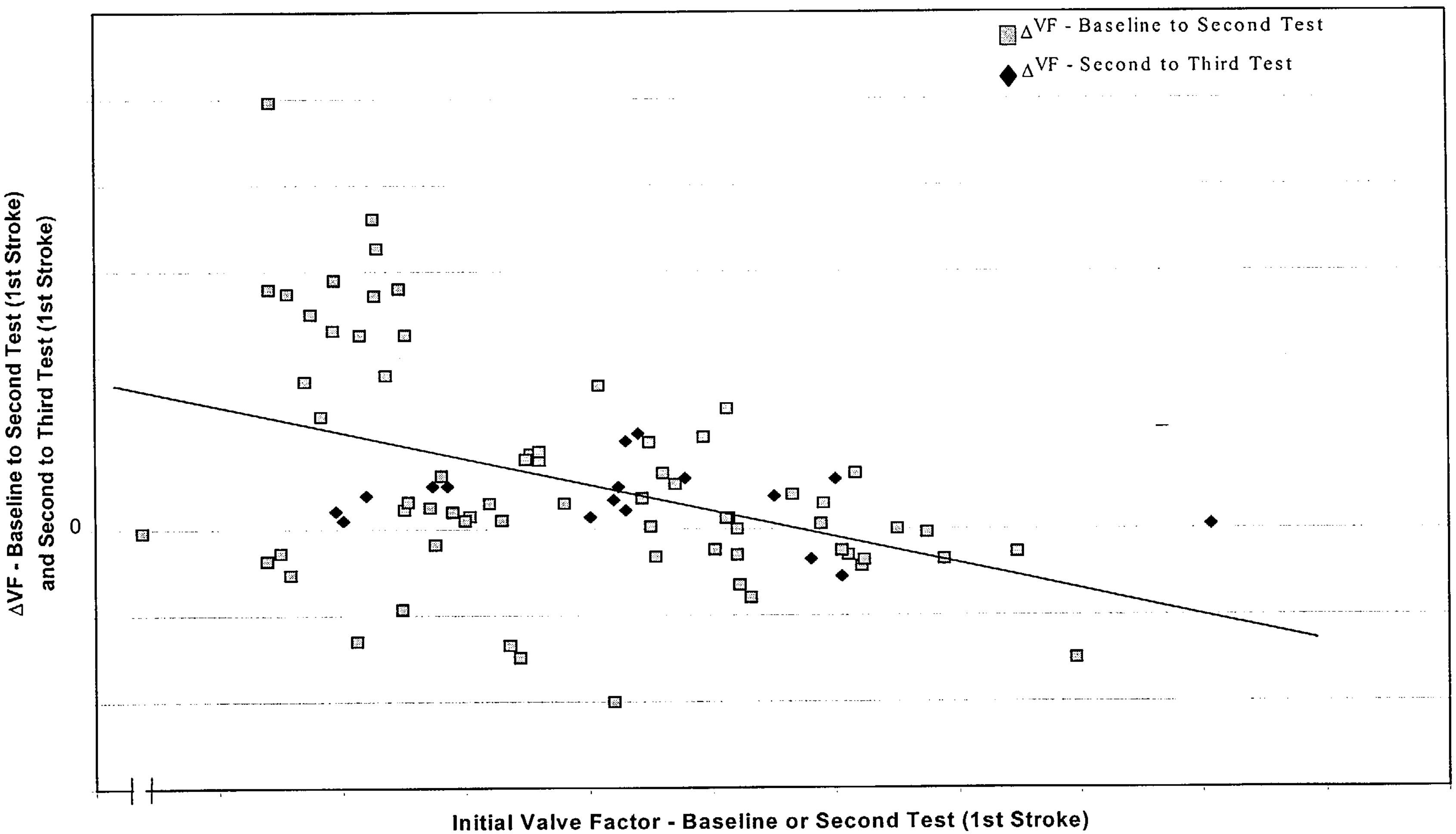
ΔValve Factor vs Initial Valve Factor - All Gate Valves in Stellite Seats/ Hot Water/Steam (outliers removed)



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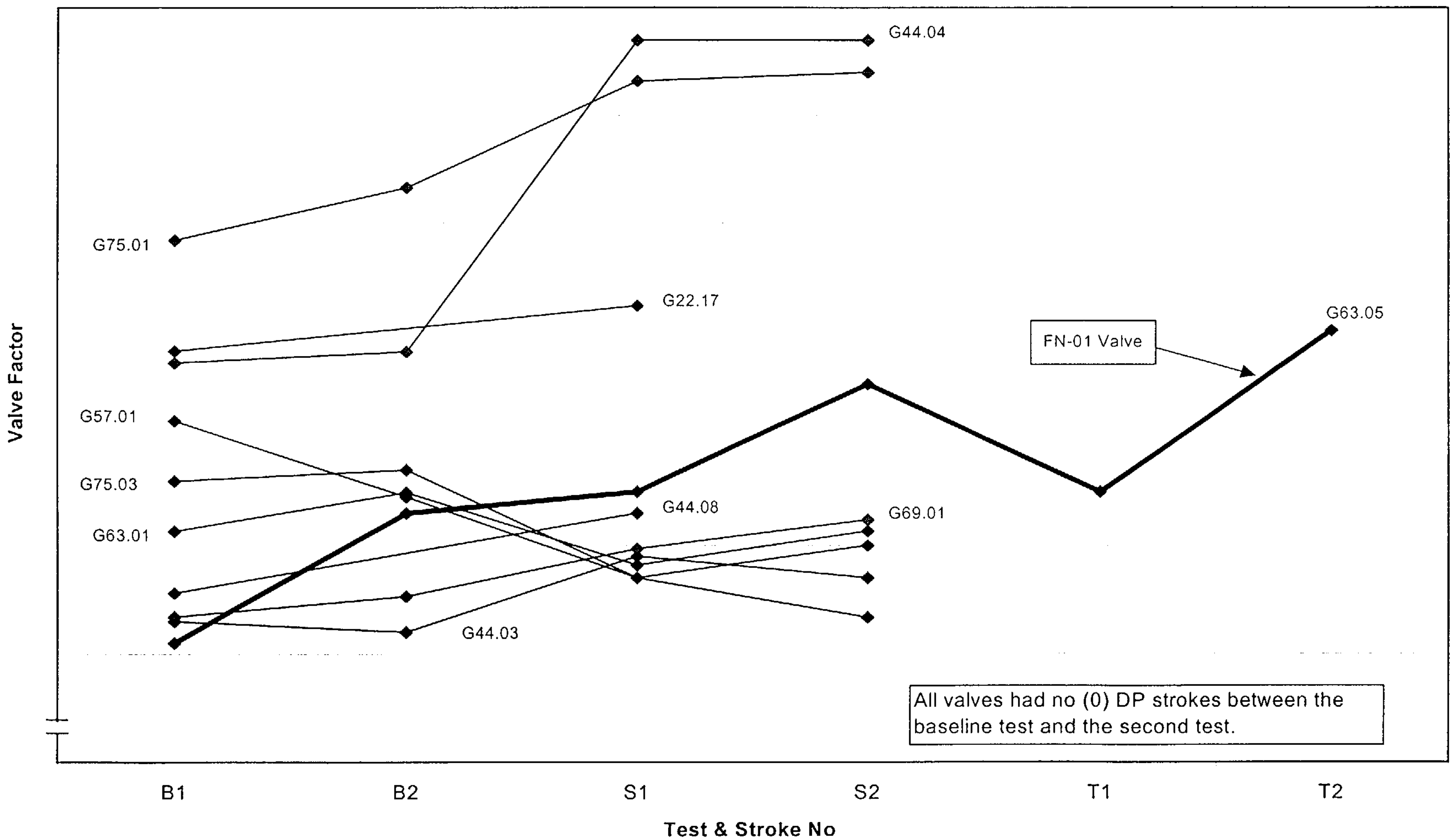
Progression of Closing Valve Factor at Initial Wedging - Stellite Seats/Cold Treated Water/No DP Strokes - No Internal Maintenance Prior to Baseline Test



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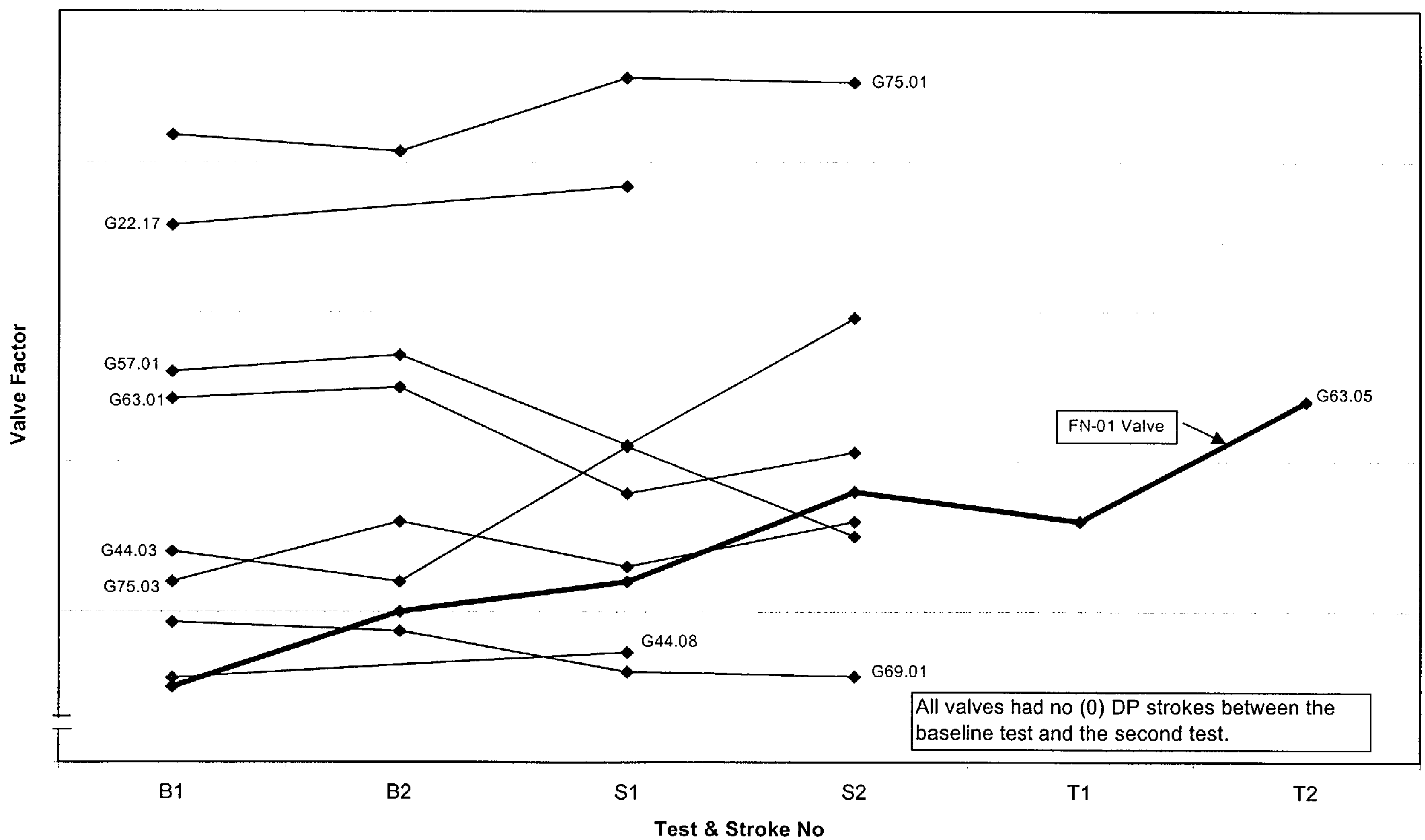

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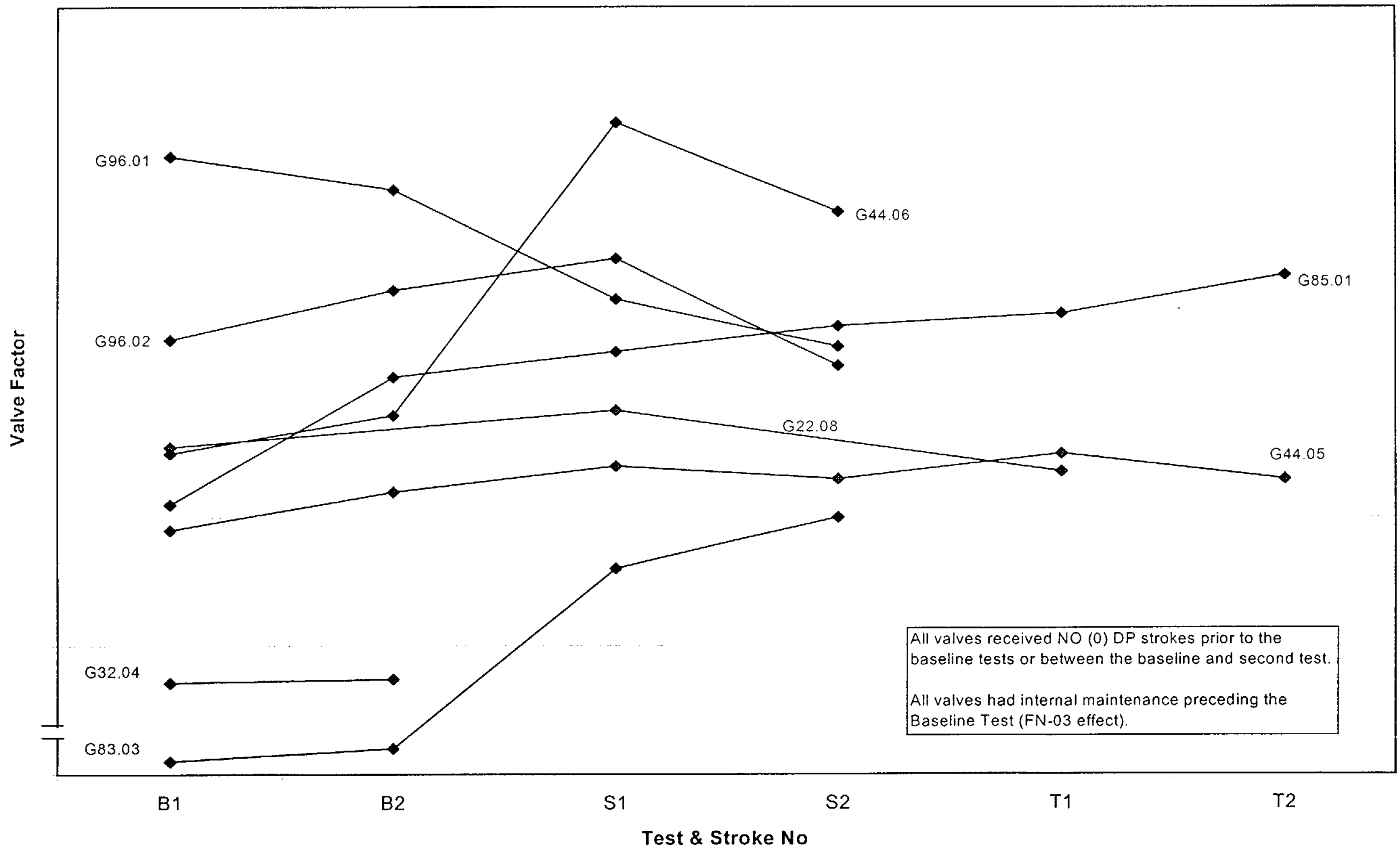

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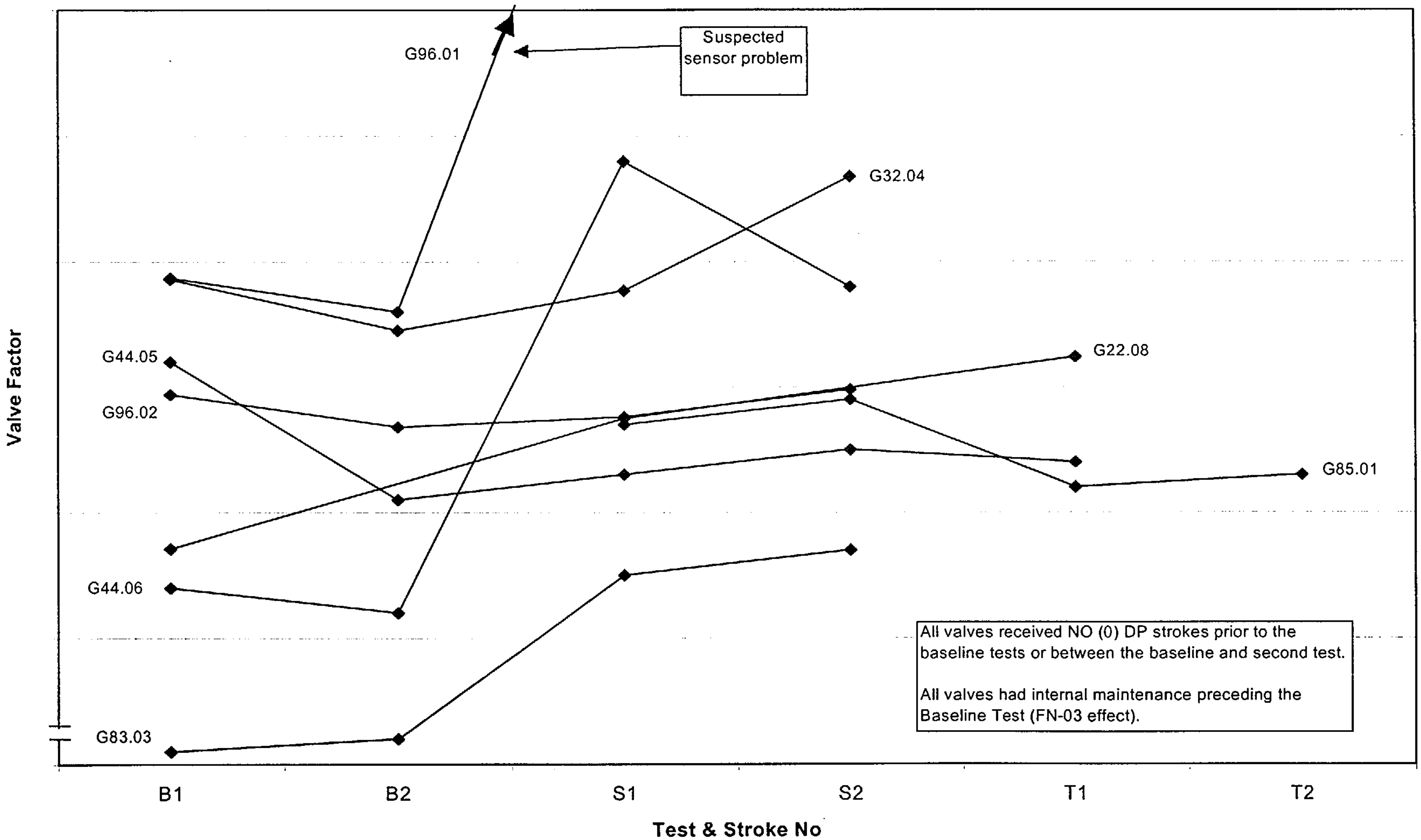

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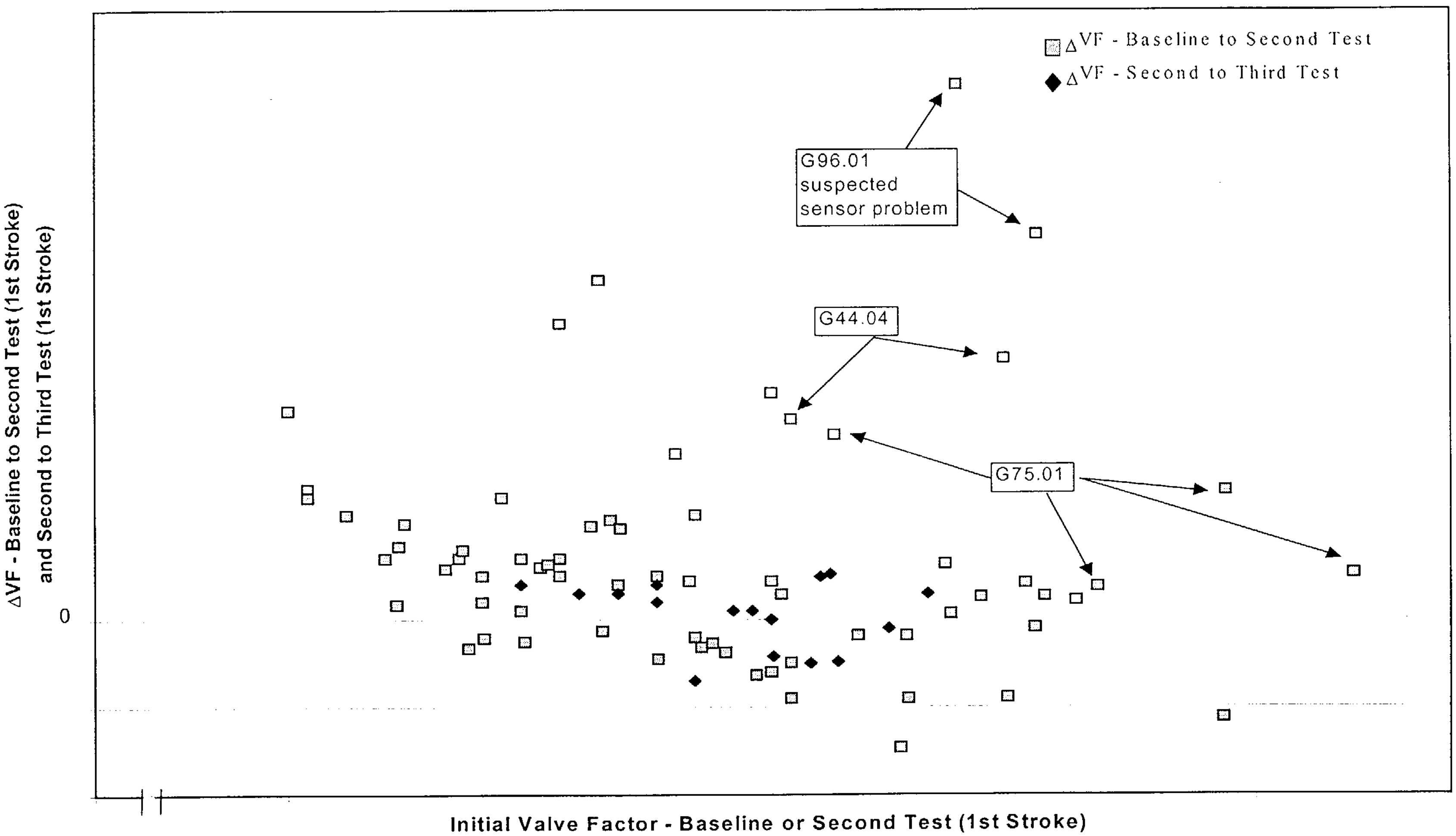
ΔValve Factor vs Initial Valve Factor - All Gate Valves in Stellite Seats/Cold Treated Water/No DP Strokes



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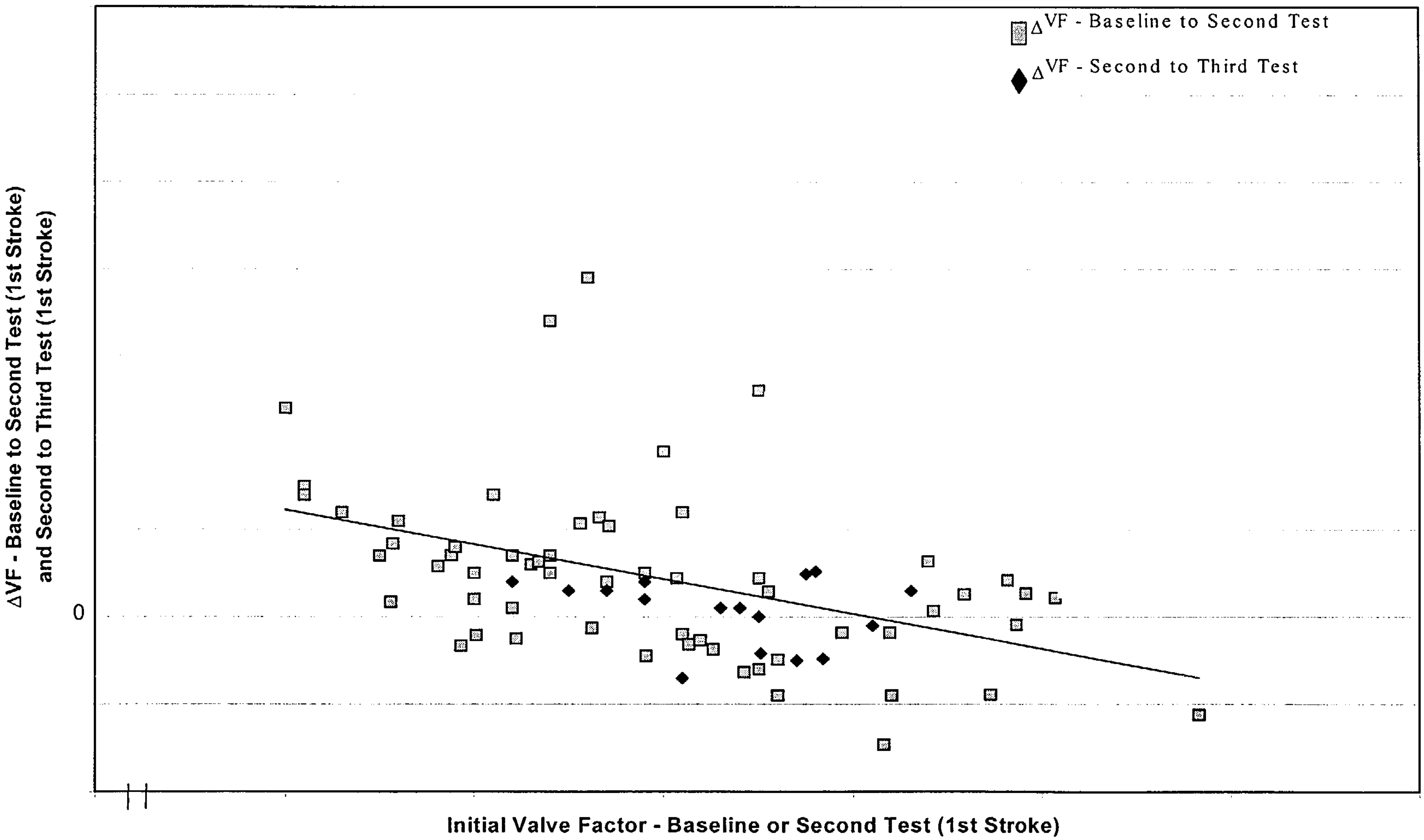
ΔValve Factor vs Initial Valve Factor - All Gate Valves in Stellite Seats/Cold Treated Water/No DP Strokes (outliers removed)



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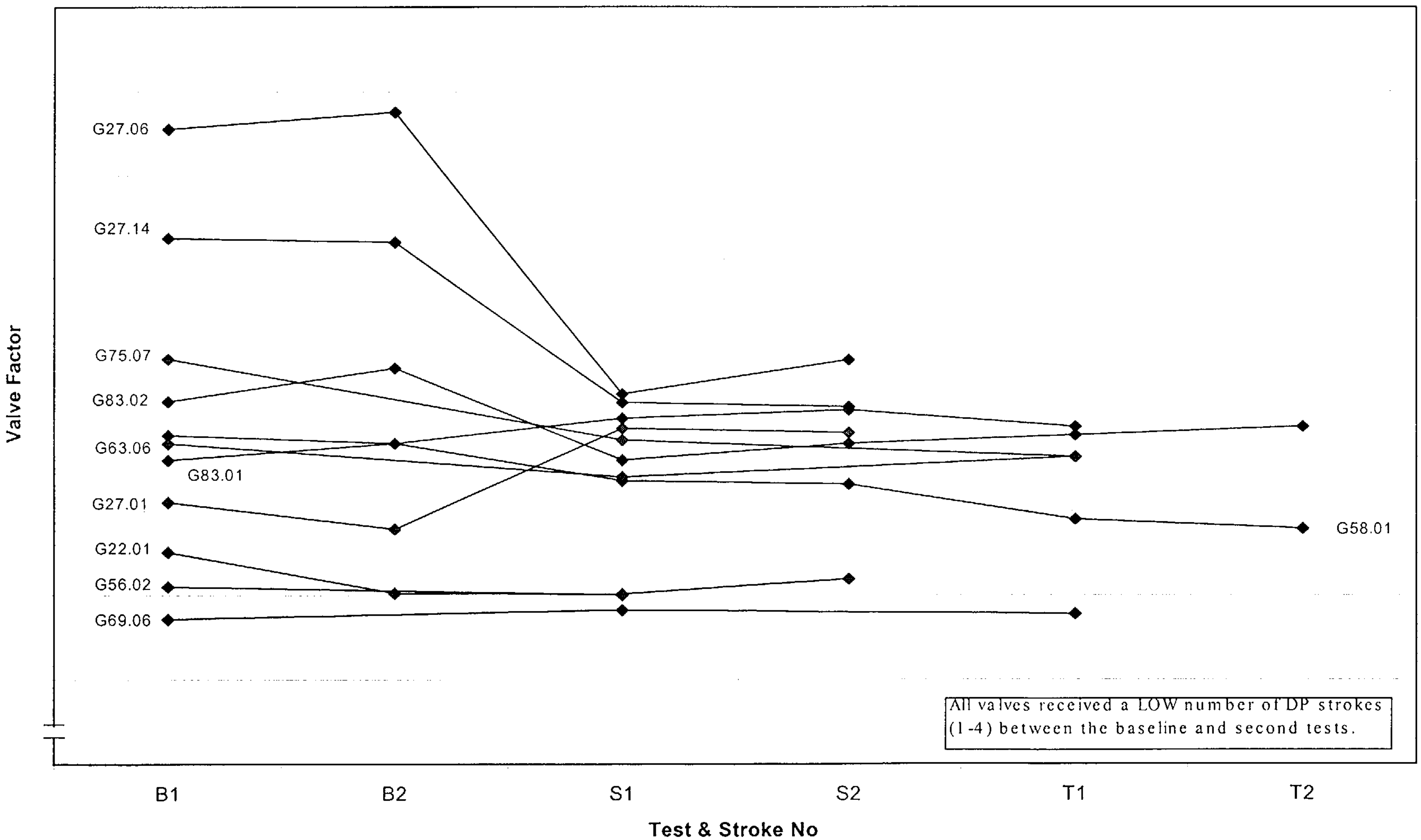
Progression of Closing Valve Factors at Initial Wedging - Stellite Seats/Cold Treated Water/Low DP Strokes - No Internal Maintenance Prior to Baseline Test



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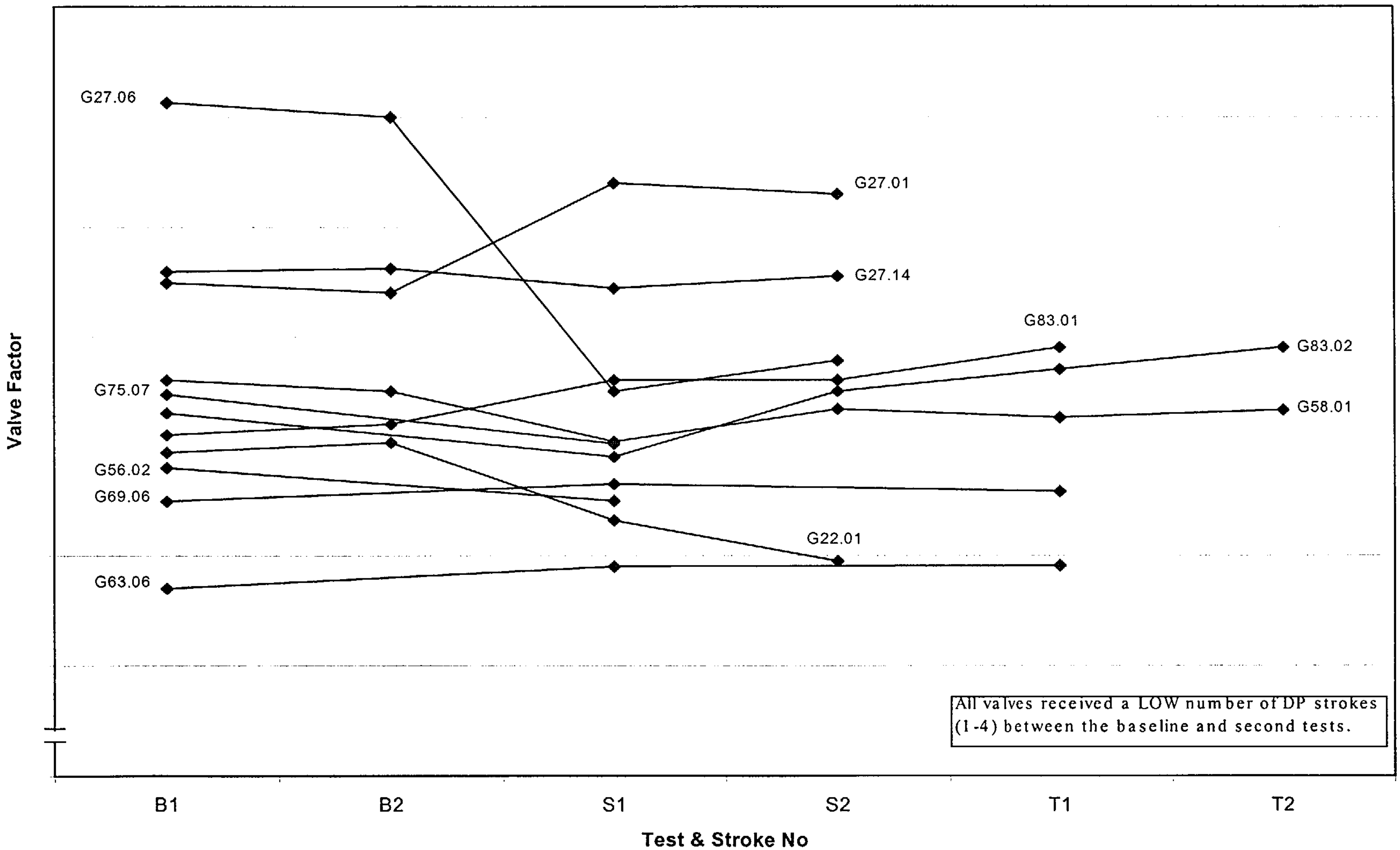

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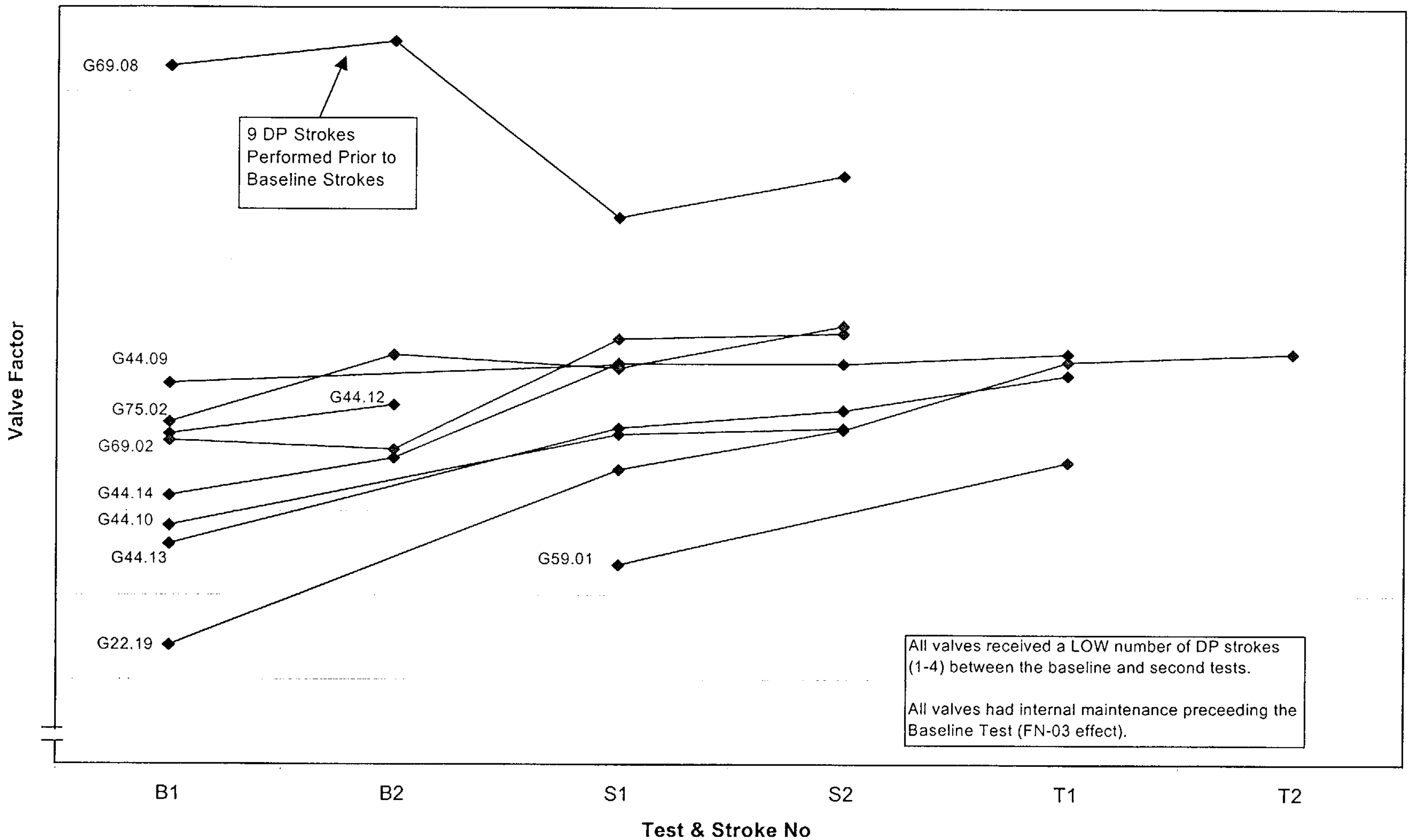

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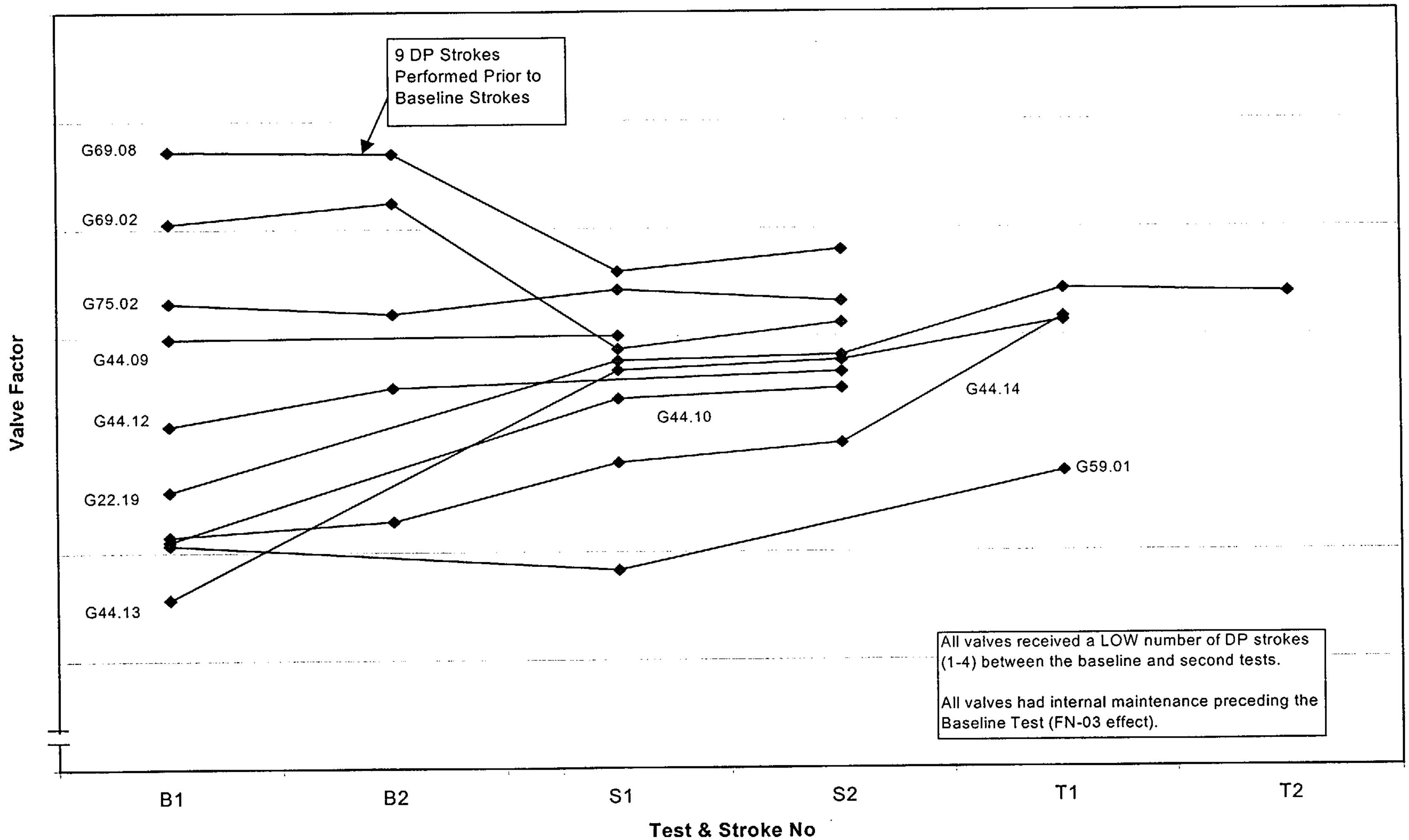

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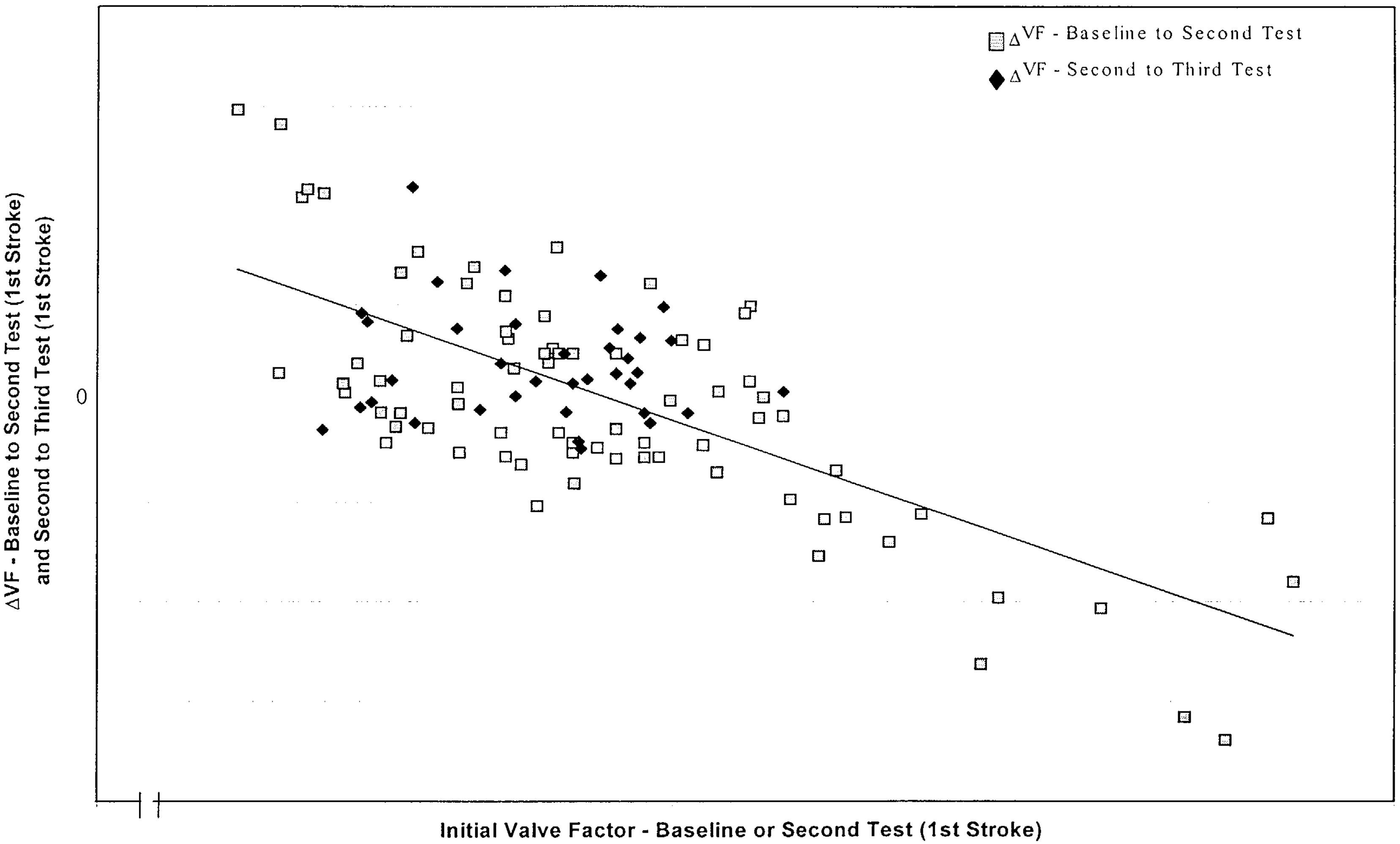
ΔValve Factor vs Initial Valve Factor - All Gate Valves in Stellite Seats/Cold Treated Water/Low DP Strokes



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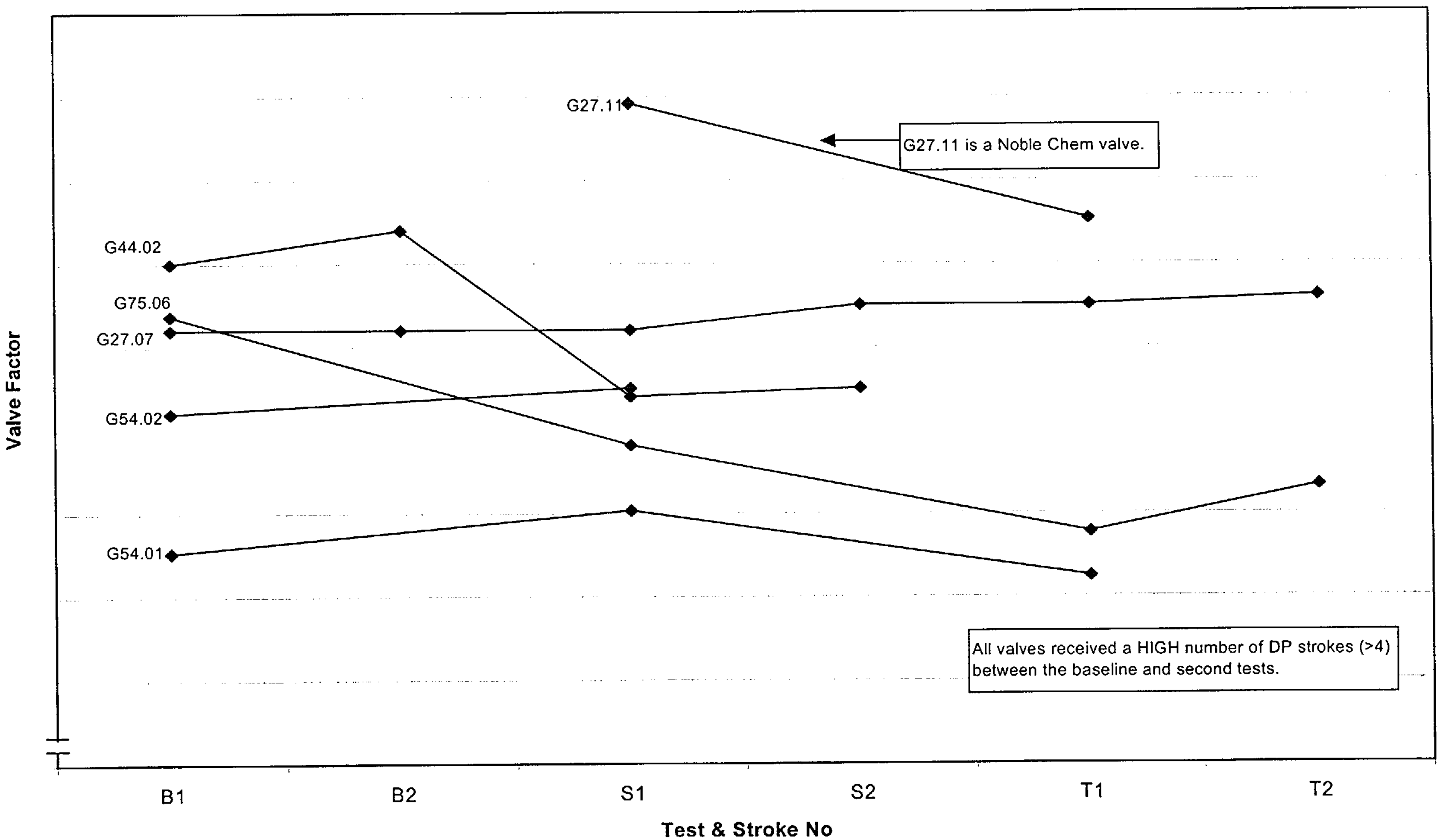
Progression of Closing Valve Factors at Initial Wedging - Stellite Seats/Cold Treated Water/High DP Strokes - No Internal Maintenance Prior to Baseline Test



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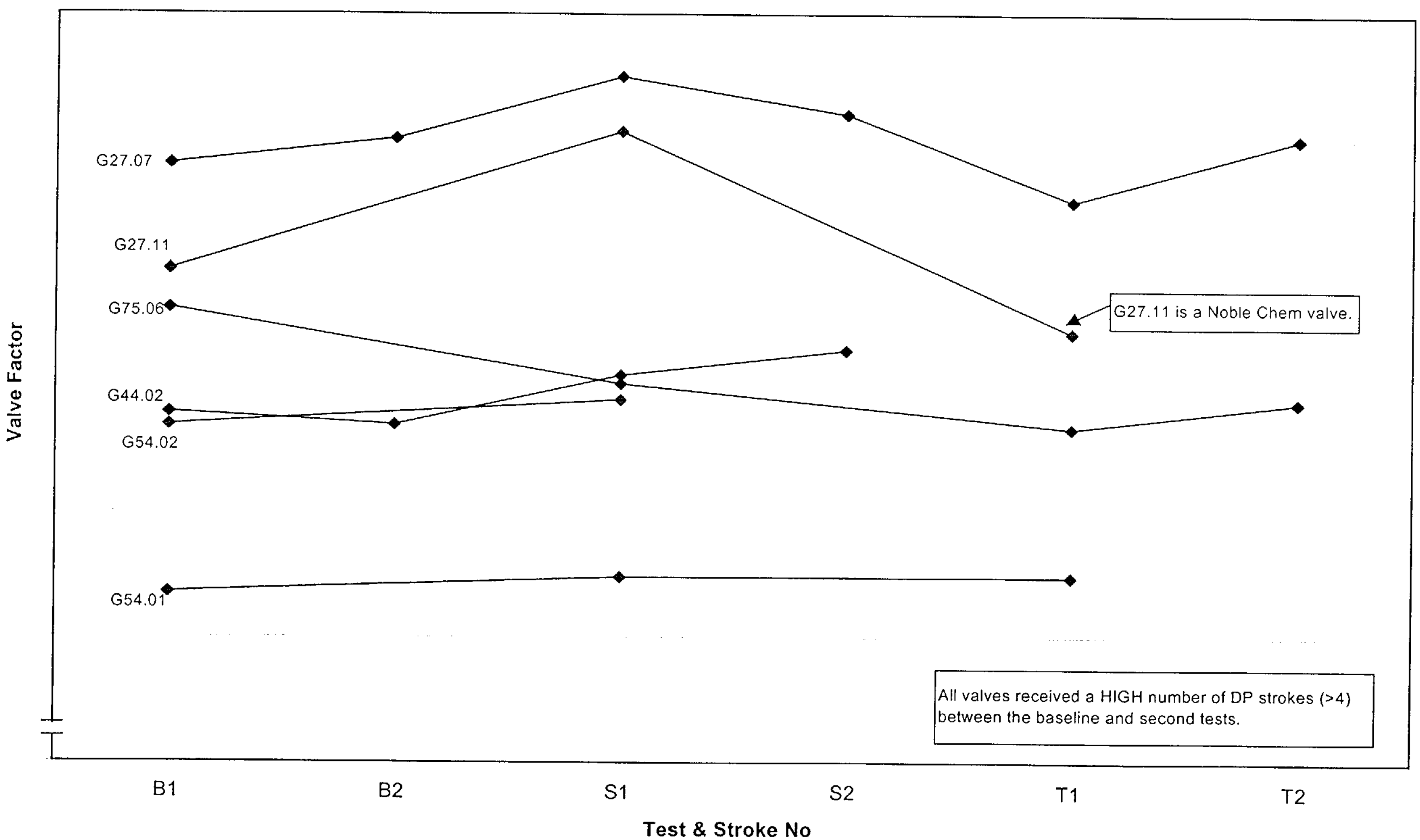

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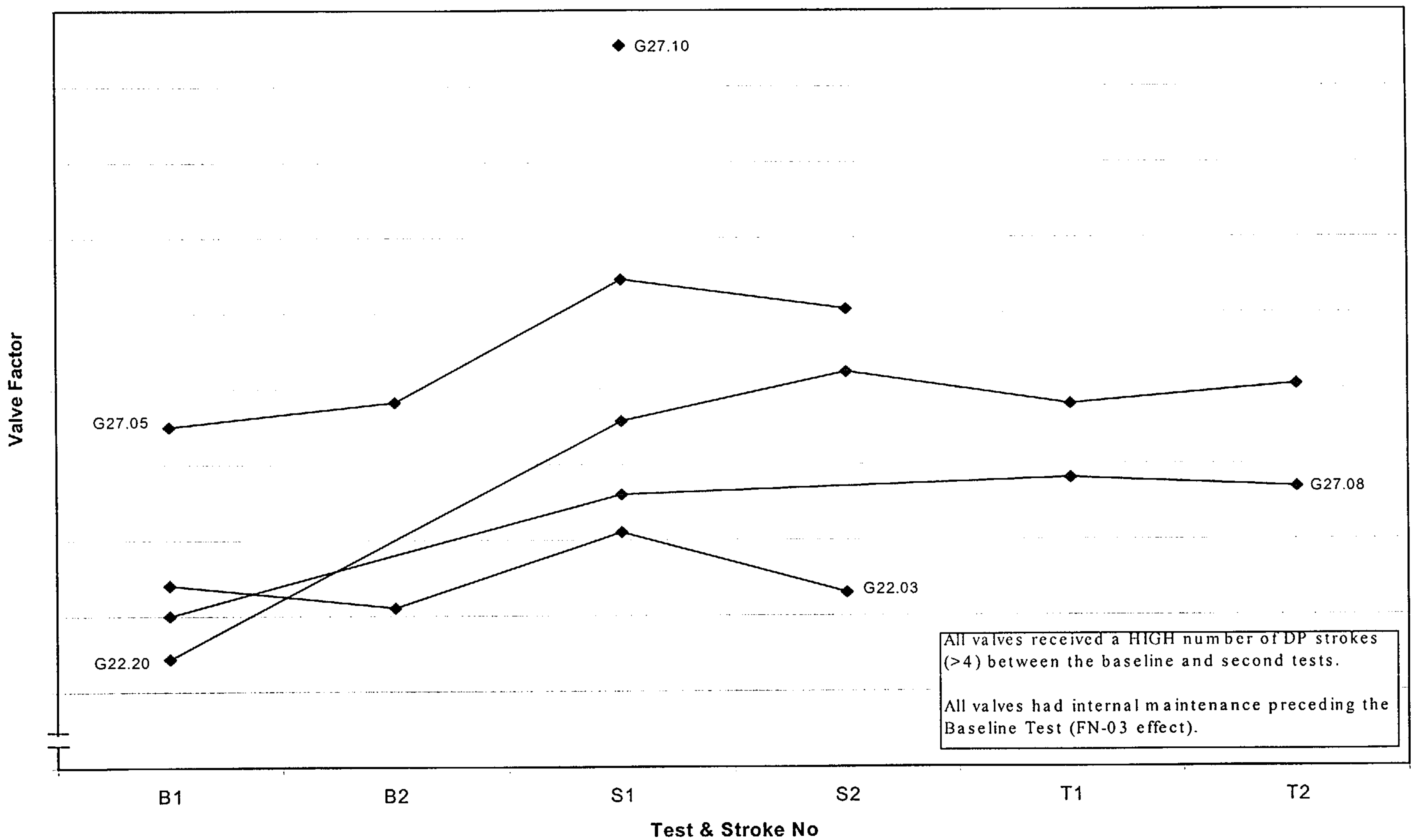

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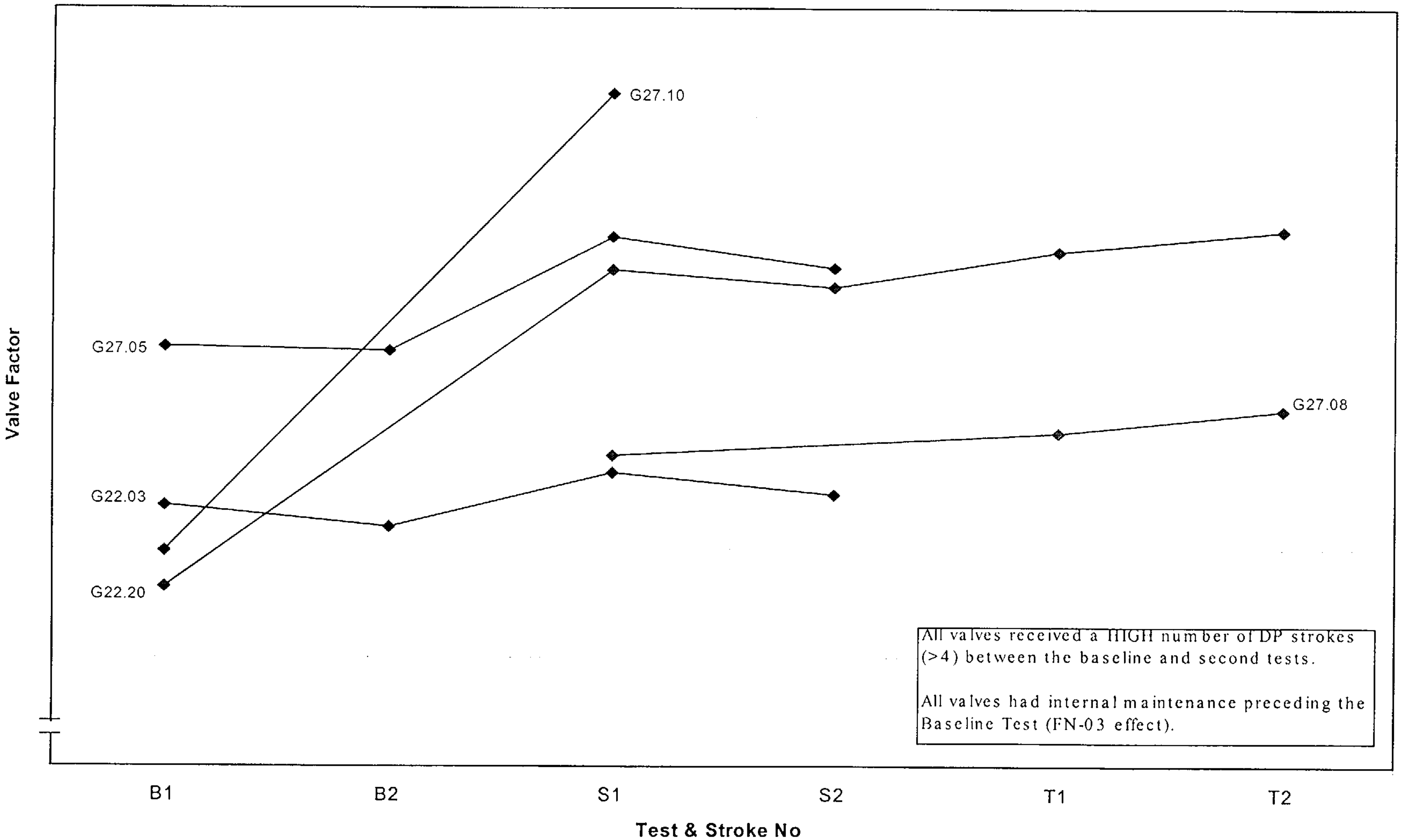

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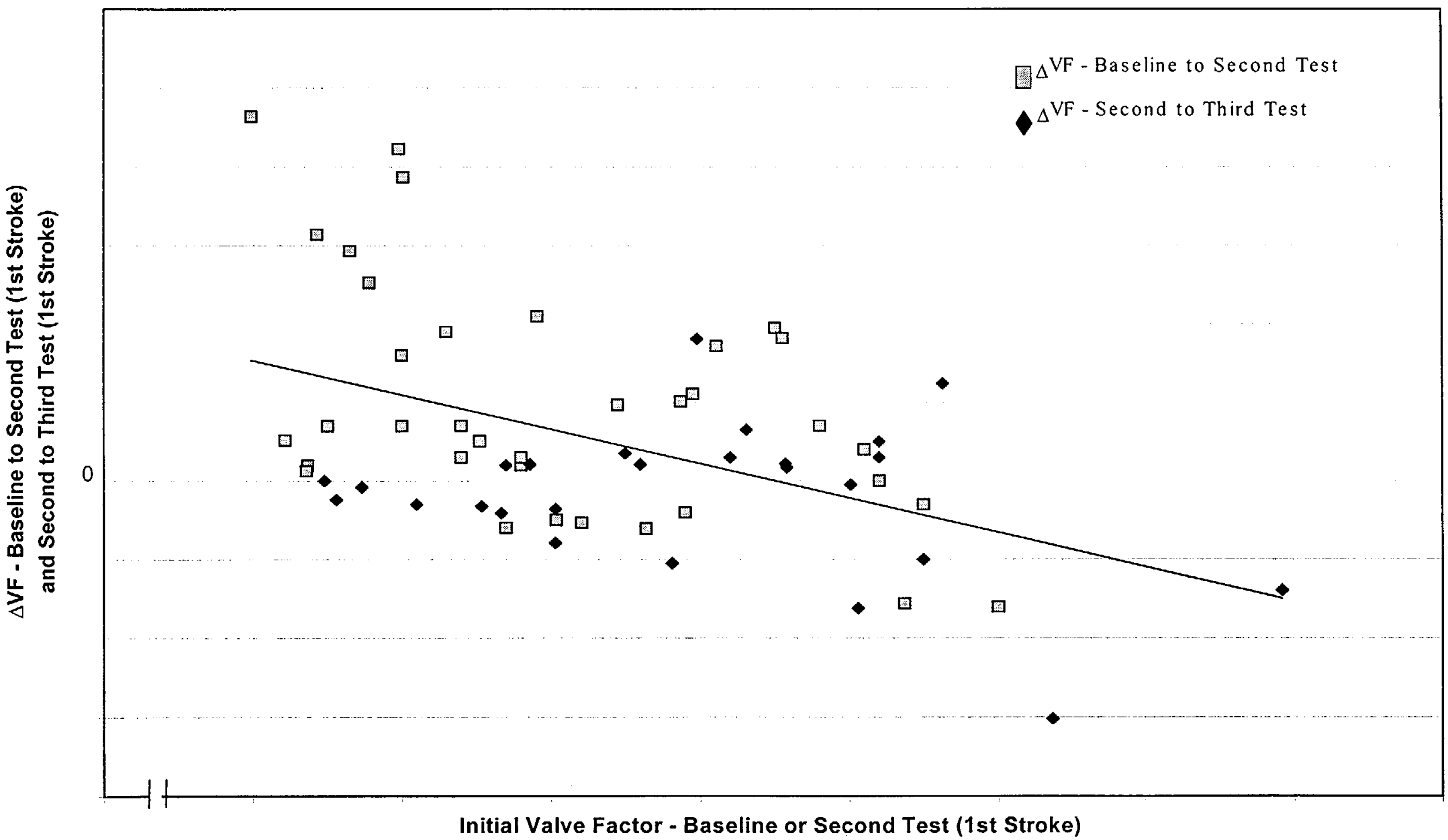
ΔValve Factor vs Initial Valve Factor - All Gate Valves in Stellite Seats/Cold Treated Water/High DP Strokes



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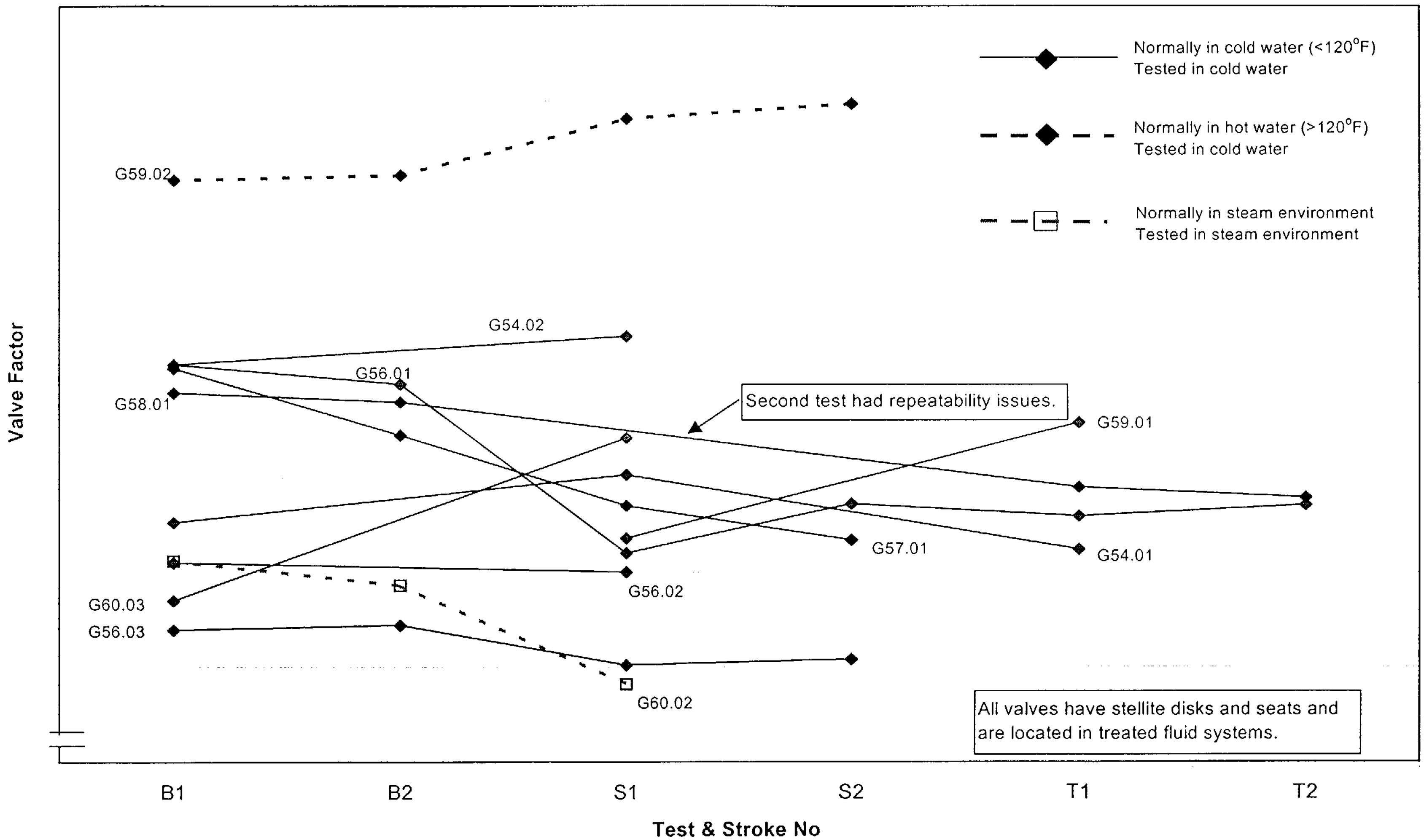
Progression of Closing Valve Factor at Initial Wedging - Double Disk Gate Valves



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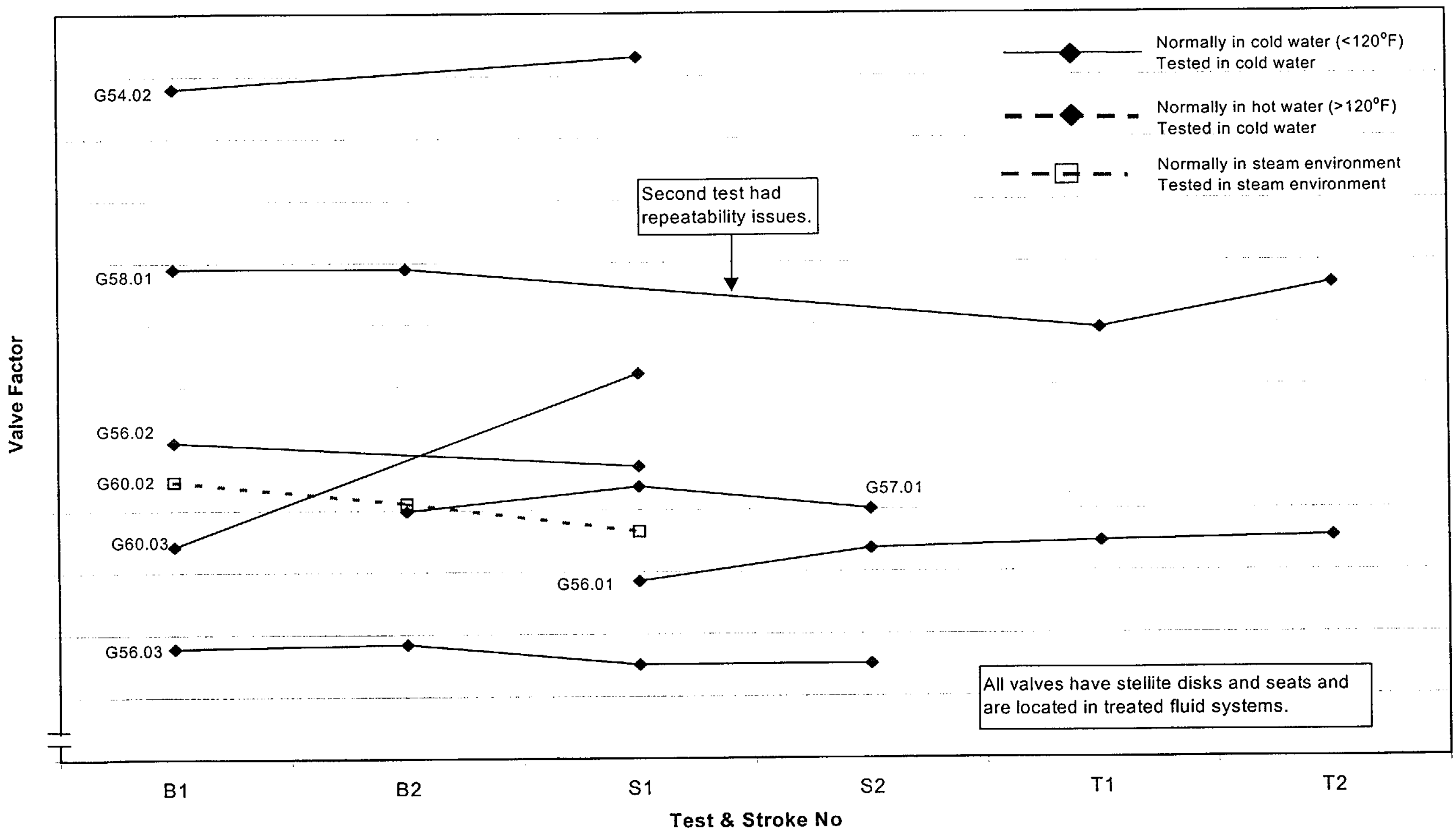
Progression of Closing Valve Factor at Initial Wedging, Point 2 - Double Disk Gate Valves



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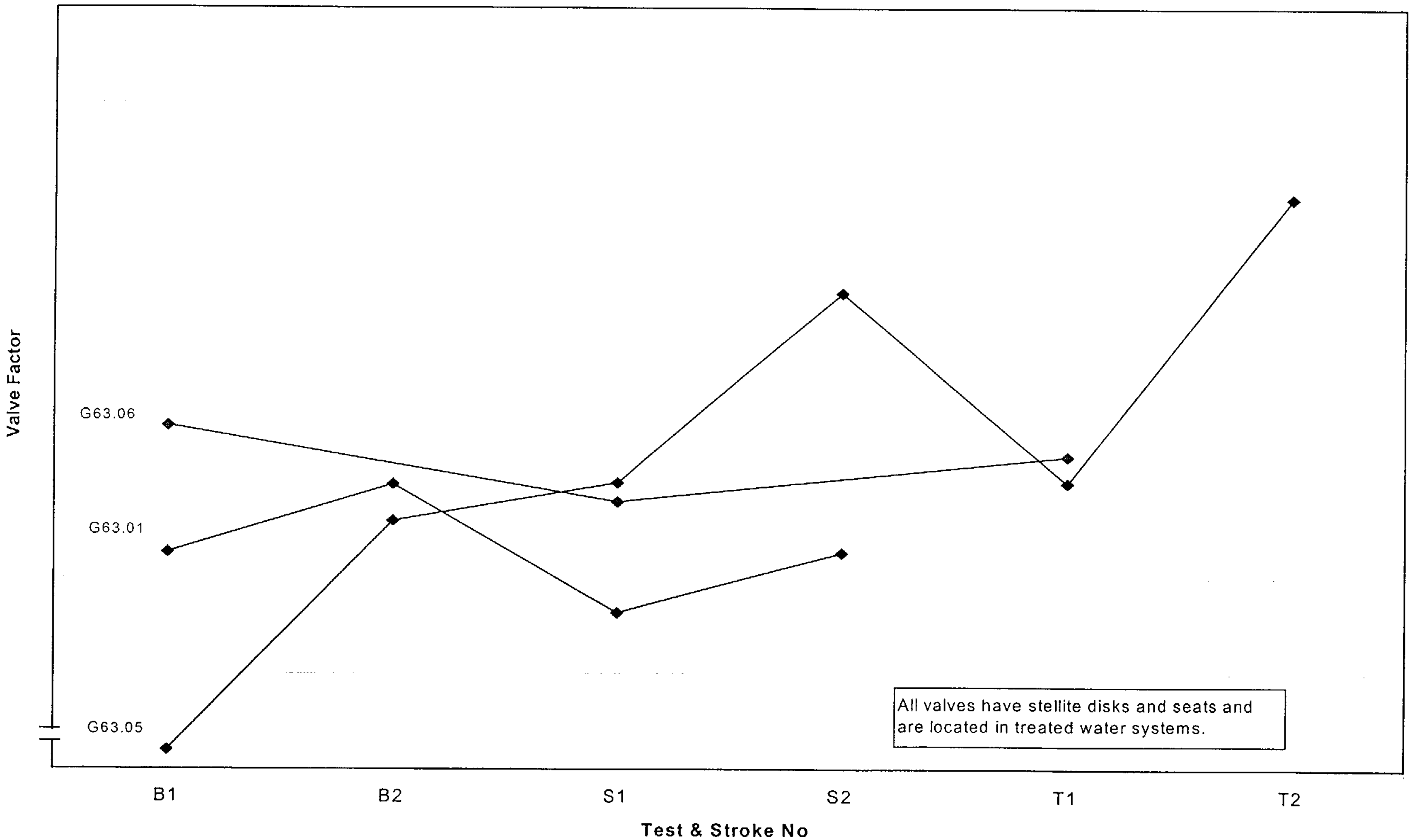
Progression of Closing Valve Factor at Initial Wedging - Split Wedge Valves



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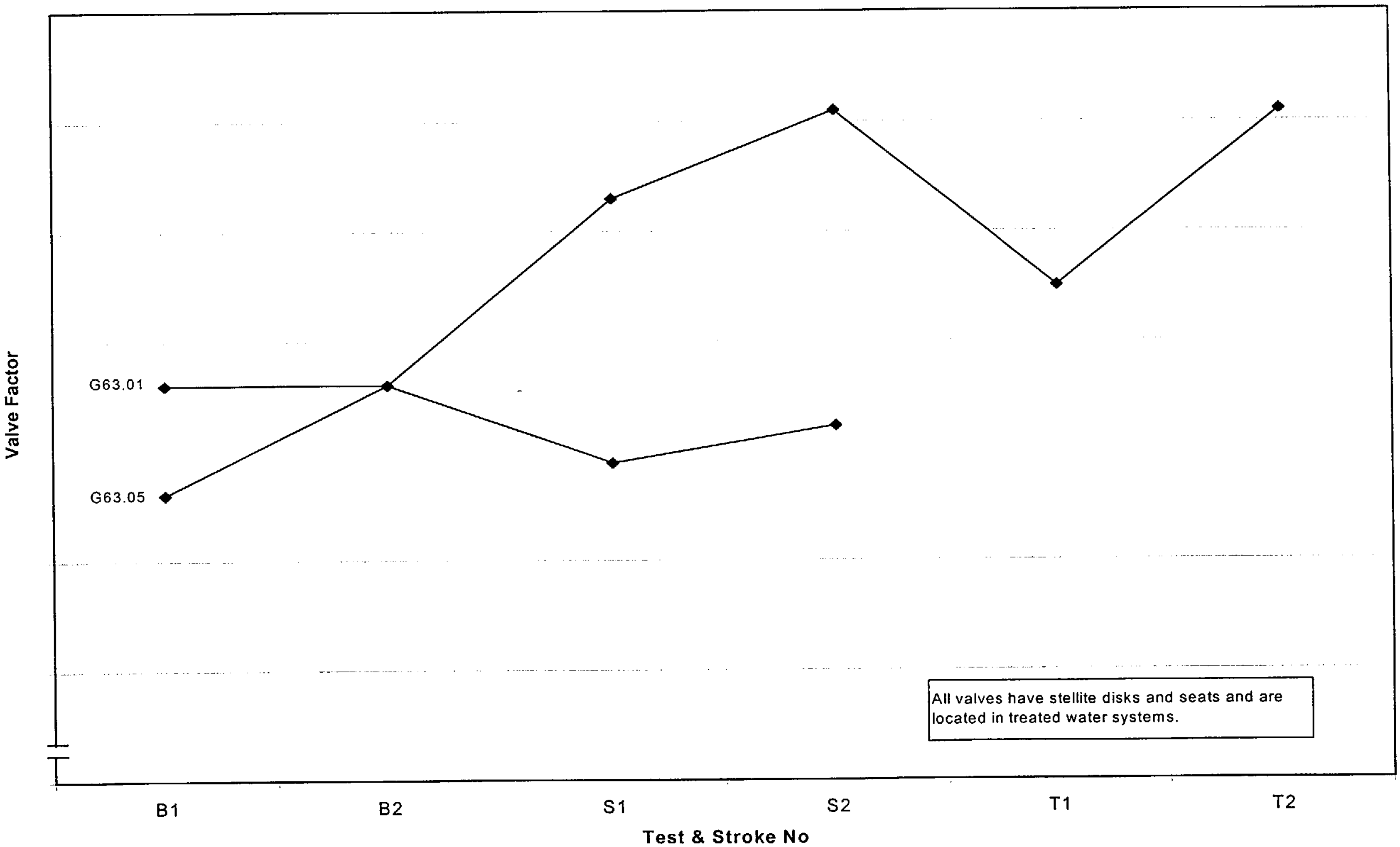

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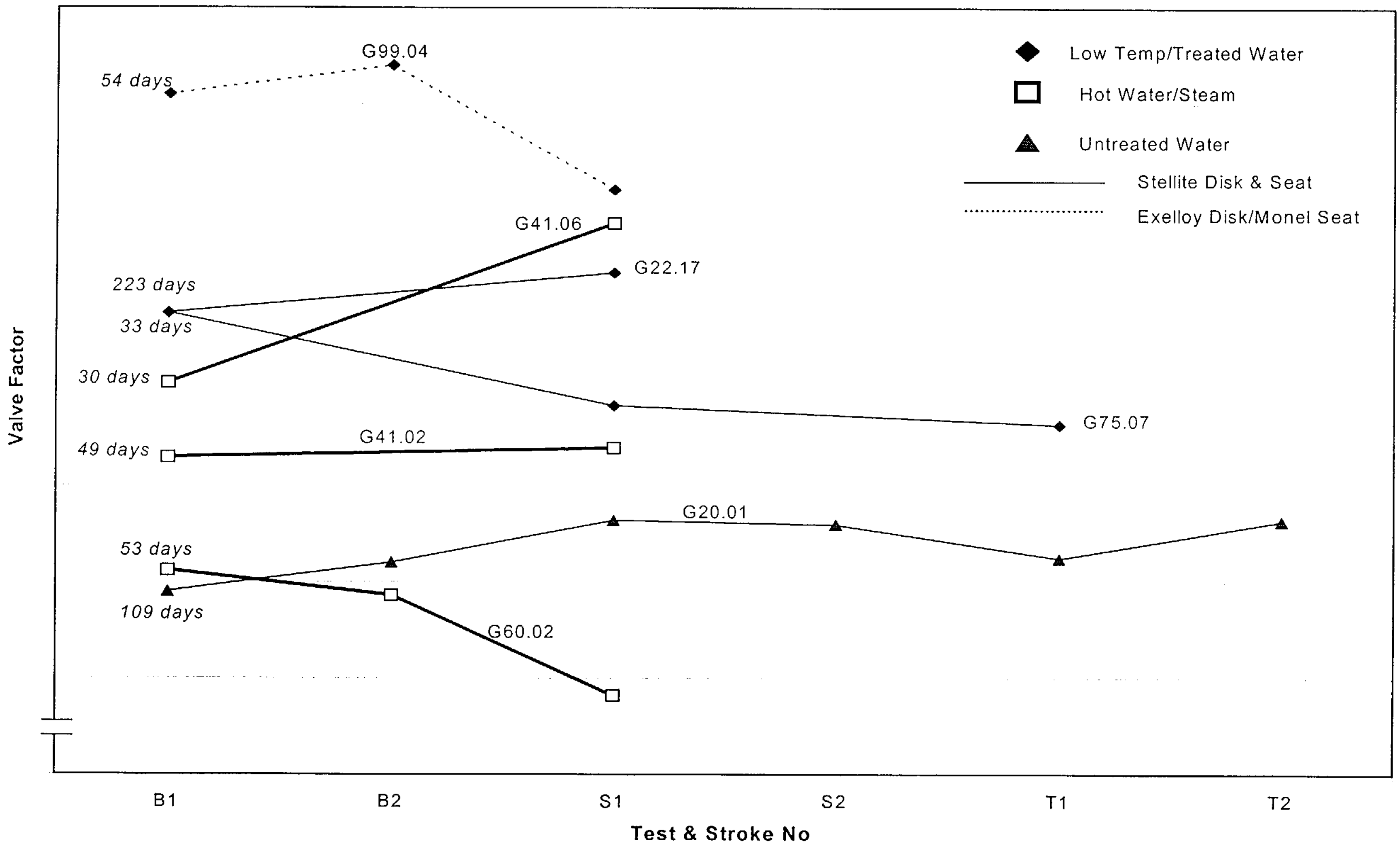
Progression of Closing Valve Factors at Initial Wedging - Baseline DP Strokes ≥30 Days After Static Stroke



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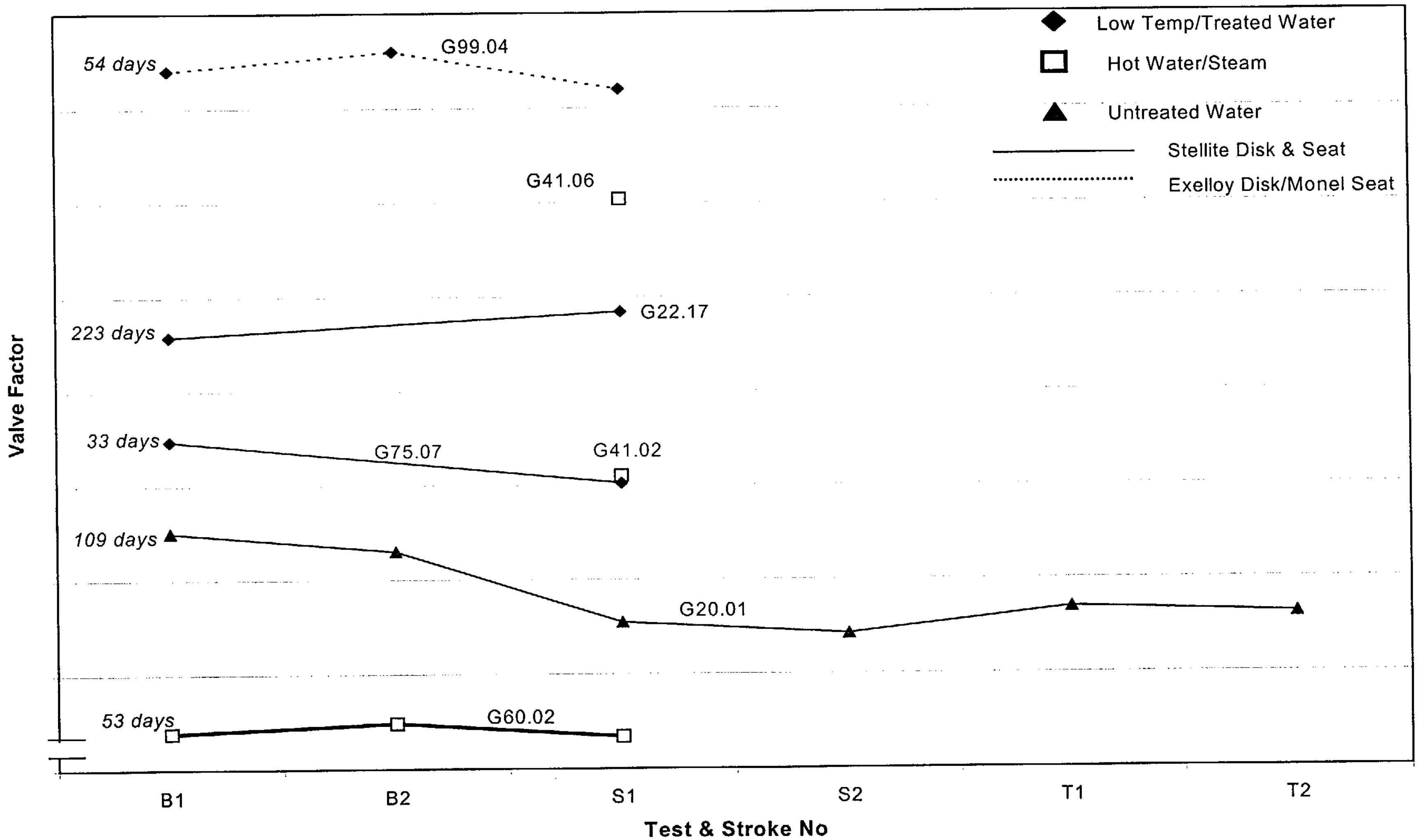
Progression of Opening Valve Factors at Flow Initiation - Baseline DP Strokes ≥30 Days After Static Stroke



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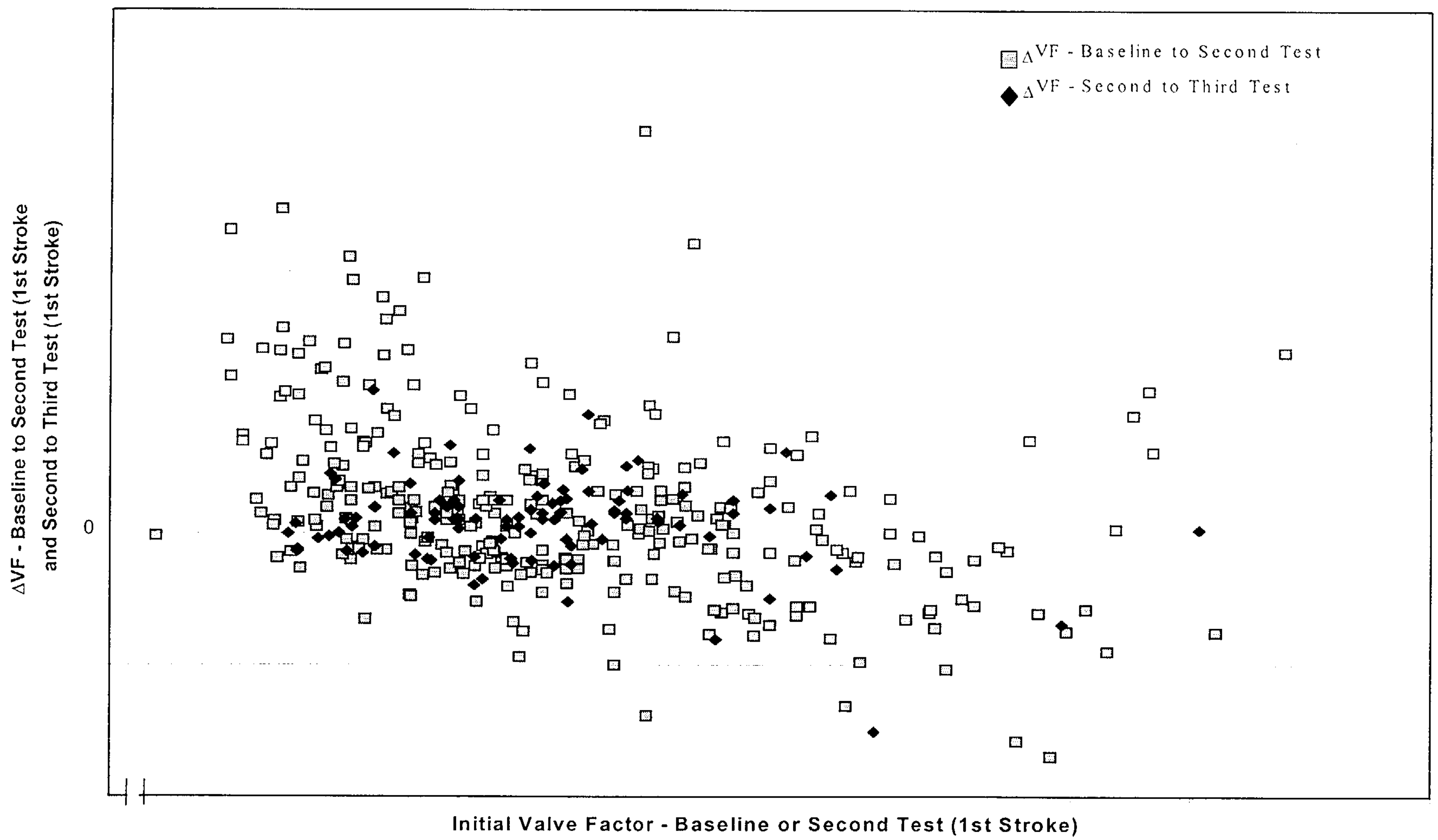
ΔValve Factor vs Initial Valve Factor - All Gate Valves



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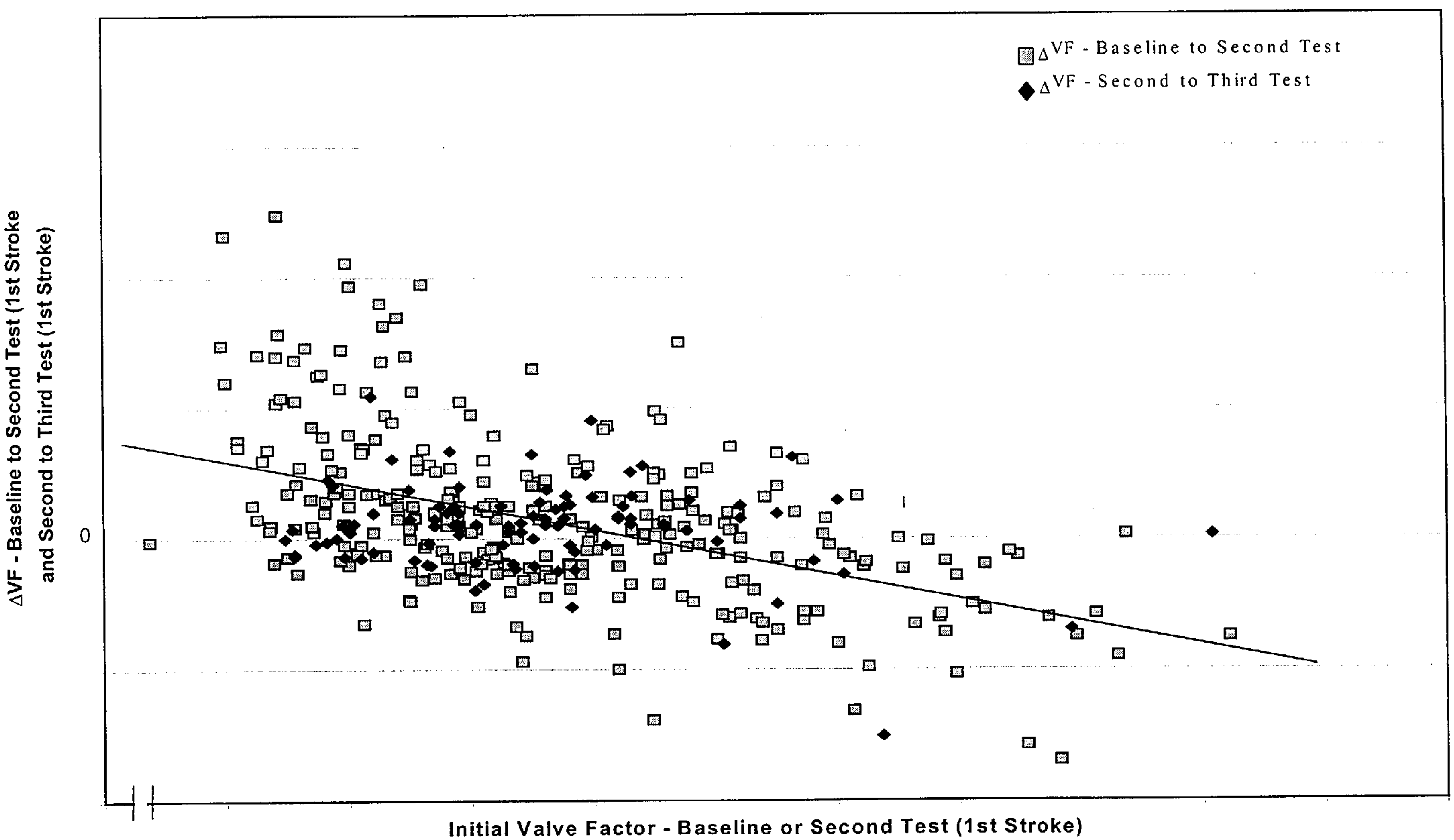
ΔValve Factor vs Initial Valve Factor - All Gate Valves (outliers removed)



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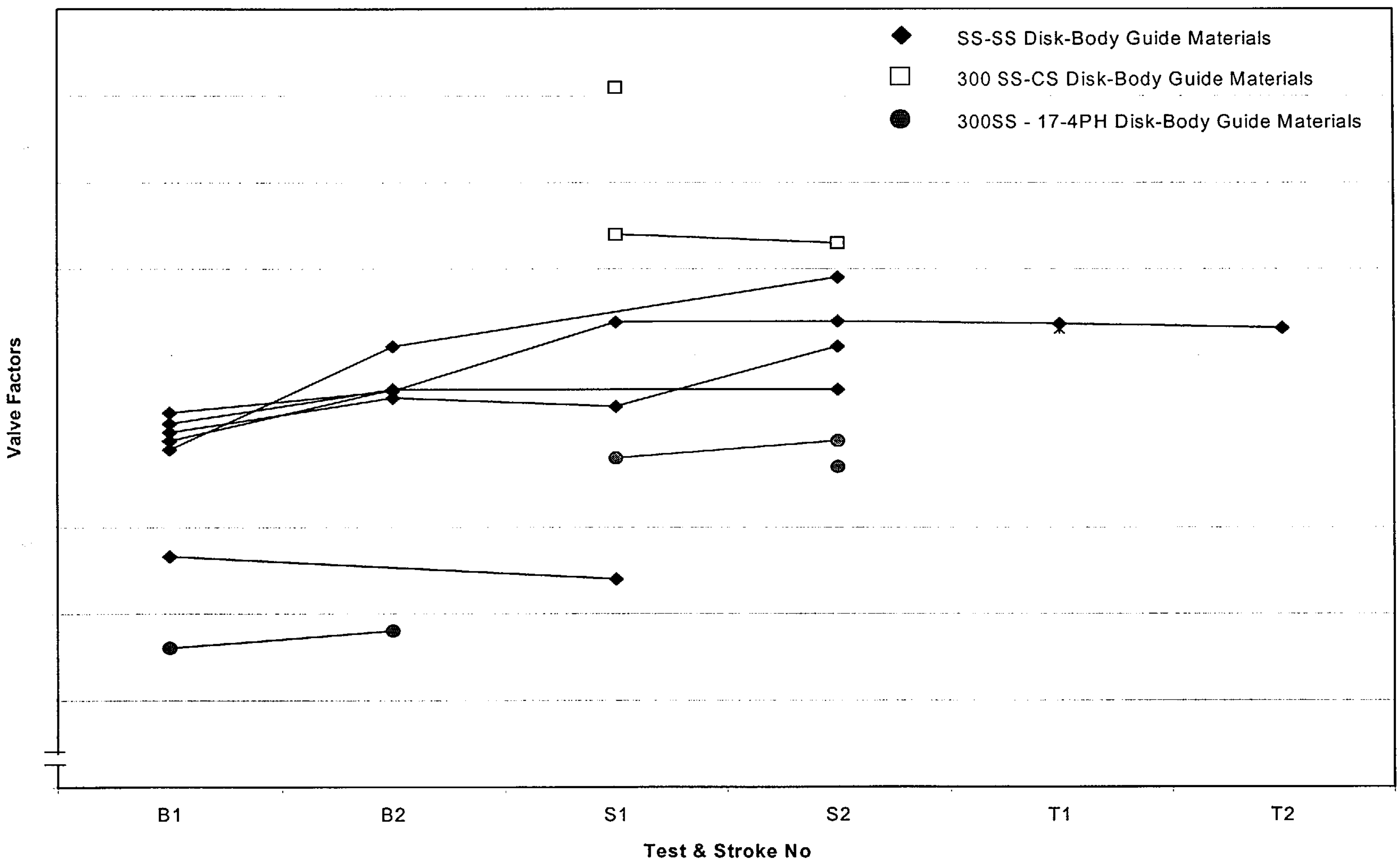
Gate Valve Test Results

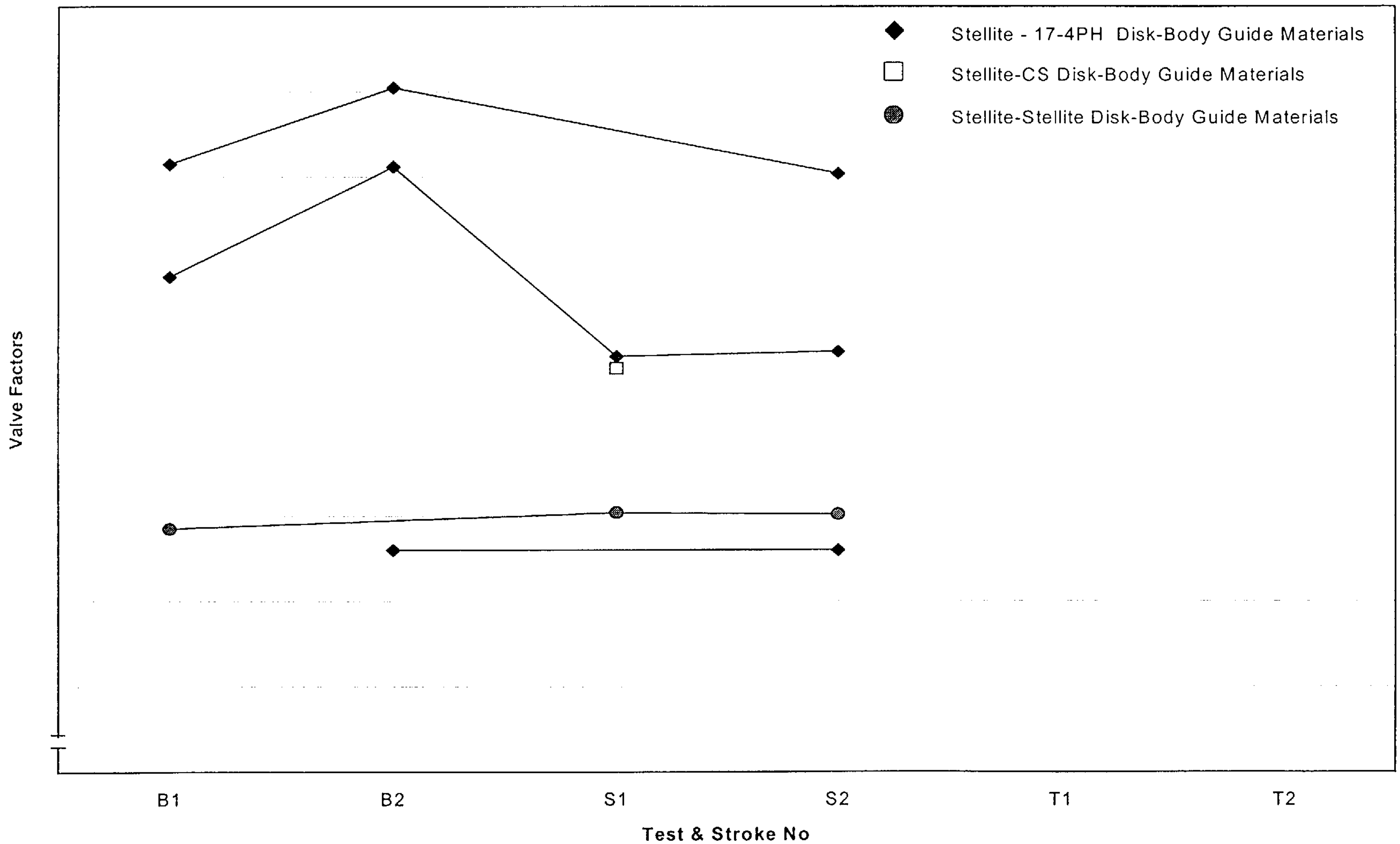
Guide Friction Evaluation

- 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 - 4 valves with repeat data
  - no degradation

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



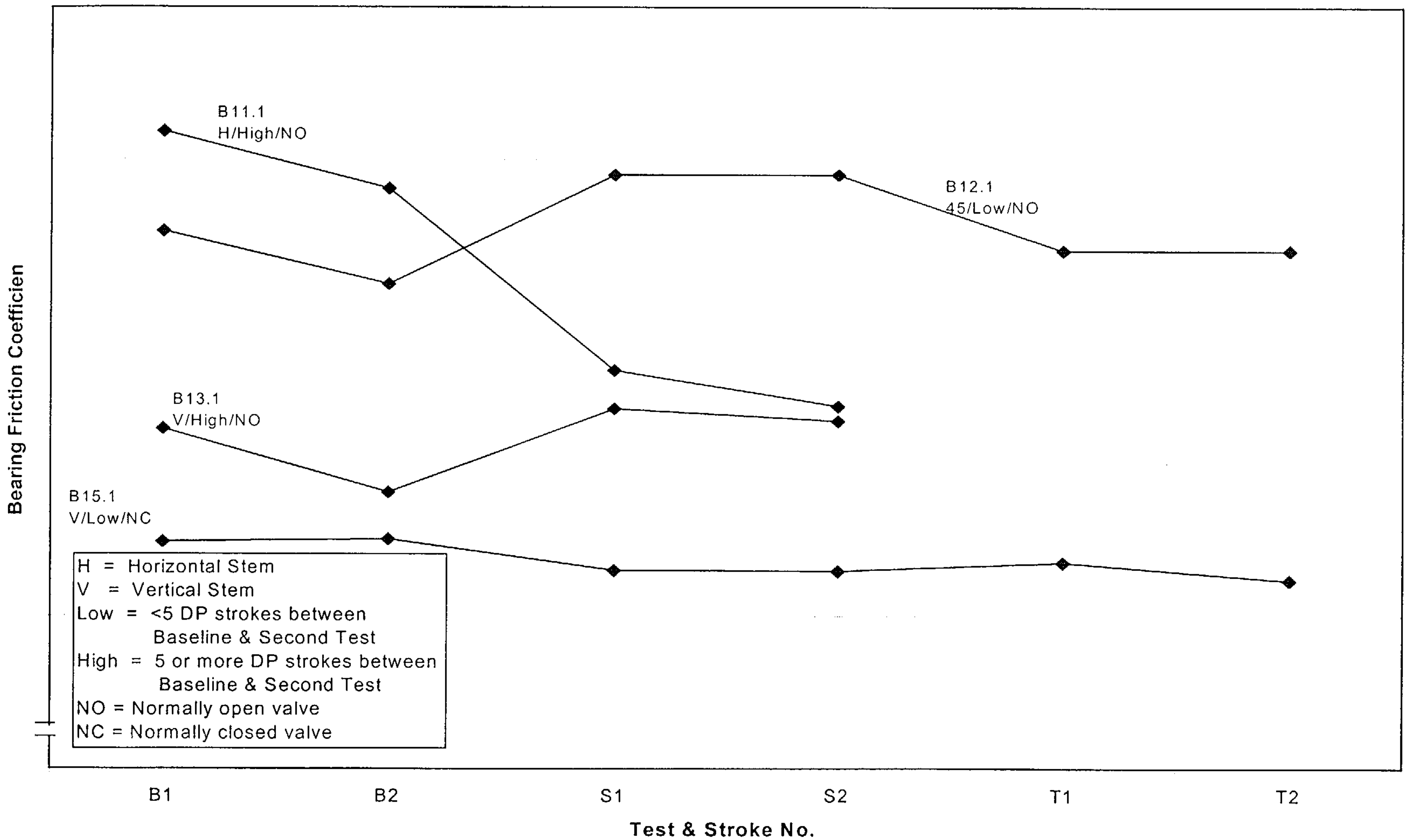
Progression of Valve Factors at Maximum After Cracking Attributable to Guide Friction - Stellite Disk Guide Material



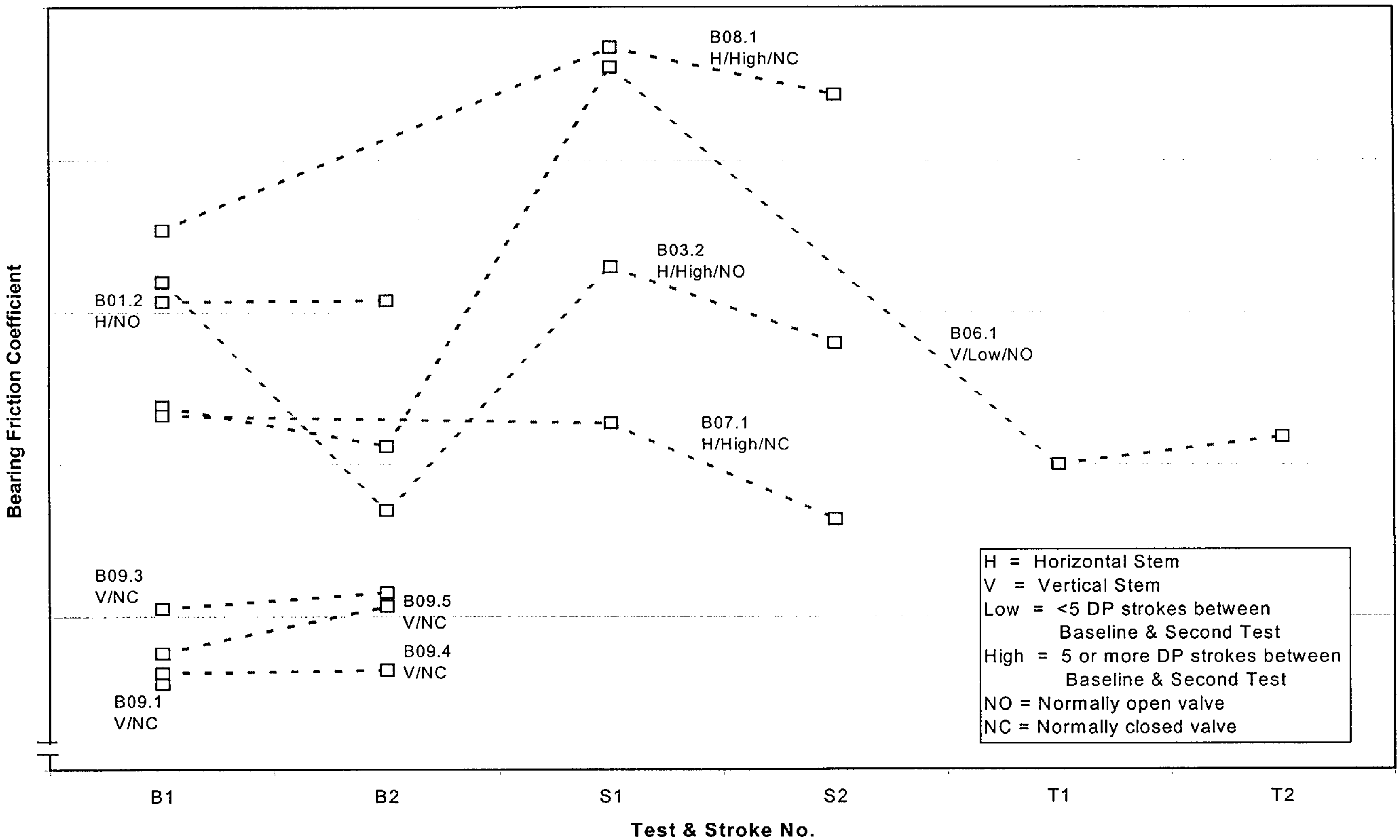
Butterfly Valve Test Results

- 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
    - Significant variations - no trend has been identified
- Non-Bronze Bearings
  - Bearing friction coefficient is stable or decreasing

Progression of Bearing Friction Coefficient for Butterfly Valves - Bronze Bearings in Treated Water



Progression of Bearing Friction Coefficient for Butterfly Valves - Bronze Bearings in Untreated Water



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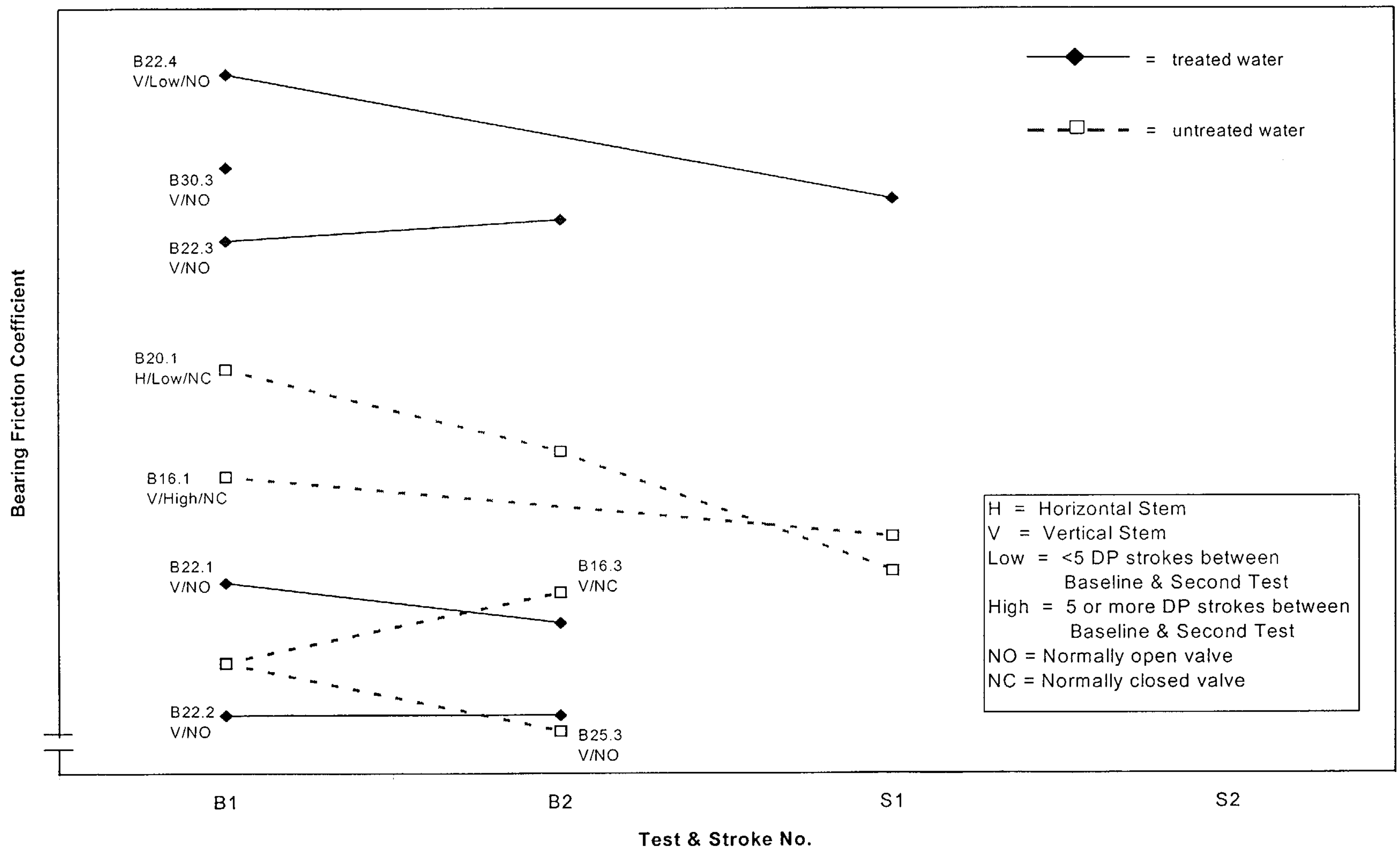
Progression of Bearing Friction Coefficient for Butterfly Valves - Non-Bronze Bearings



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Balanced Disk Globe Valves

- **<u>Scope of Testing</u> - 8 Valves in Program**
  - guide material combinations including CS, 300SS, 400SS, 17-4PH, Stellite and Bronze
  - 4 manufacturers
  - valve sizes from 2 to 16 inches
  - 3 normally open; 5 normally closed
  - test DPs from 85 to 1900 psi
  - flow velocites from 10 - 50 ft/sec (pipe area); 10 - 85 ft/sec (seat area)

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Balanced Disk Globe Valves (cont'd)

- **Scope of Testing (cont'd)**
  - water temperatures from 49 to 94°F
  - 5 treated water; 3 untreated water
  - 3 low DP stroking ($\leq$2/yr); 5 high DP stroking (4 to 75/yr)
  - 3 overseat flow; 5 underseat flow

CONCLUSION:

Good coverage of desired valve configurations and flow conditions.

Balanced Disk Globe Valves (cont'd)

- **Status of Tests Completed and Approved**

  Baseline only: 1 valve

  Baseline and second tests: 4 valves

  Baseline, second and third tests: 3 valves

CONCLUSION:

63% (10/16) of repeat tests completed (18/24 total tests). Good basis to examine results and conclusions.

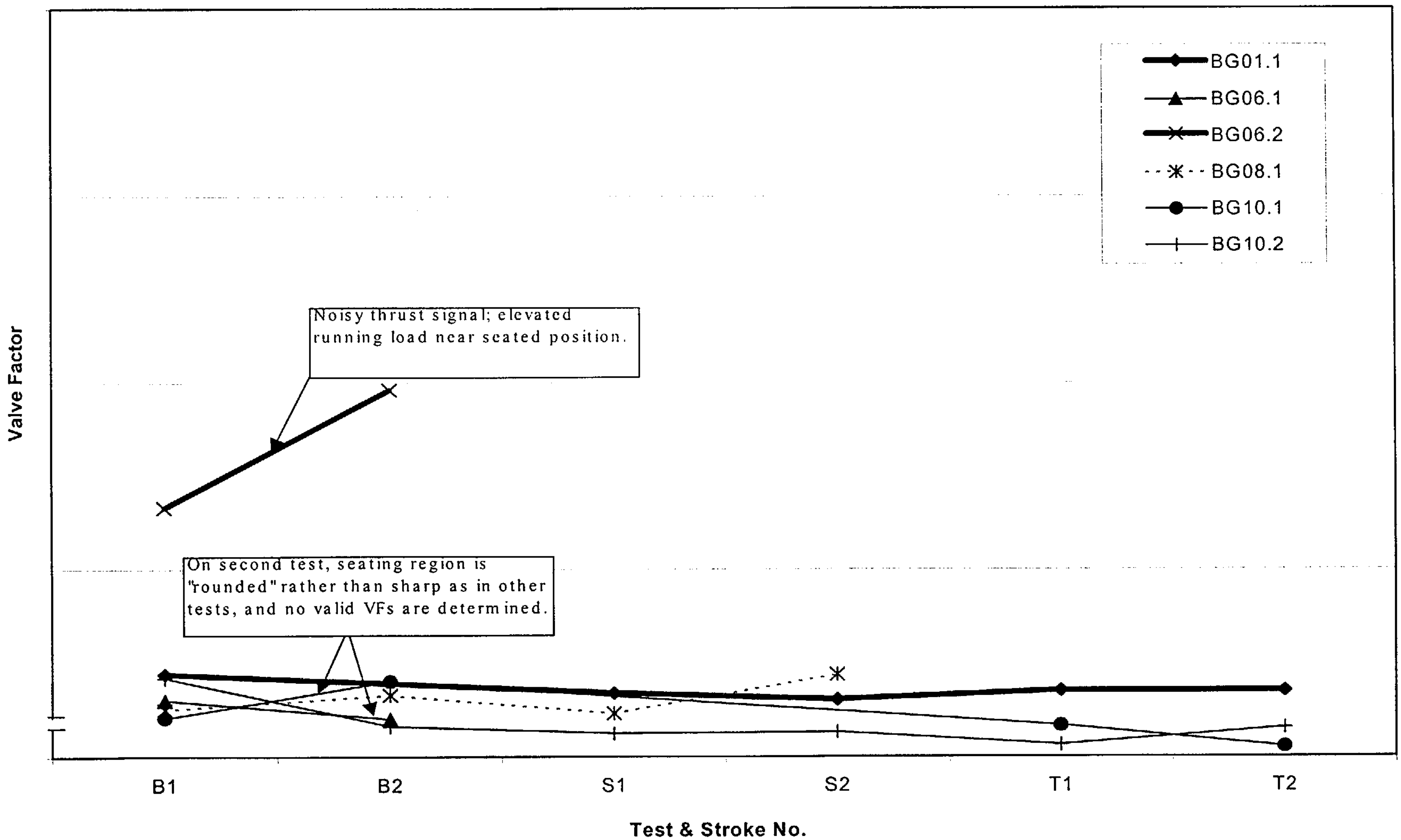
Balanced Disk Globe Valves (cont'd)

- **Test Results**
  - All valves show low DP thrusts (expected)
  - Repeat tests show no degradation
  - Untreated water valves show thrust variation (not degradation)

CONCLUSIONS:

- **No degradation in DP thrust for balanced disk globe valves in water systems.**
- **DP thrust is small and valves are not sensitive to degradation.**

Progression of Valve Factor for Balanced Disk Globe Valves at Seating



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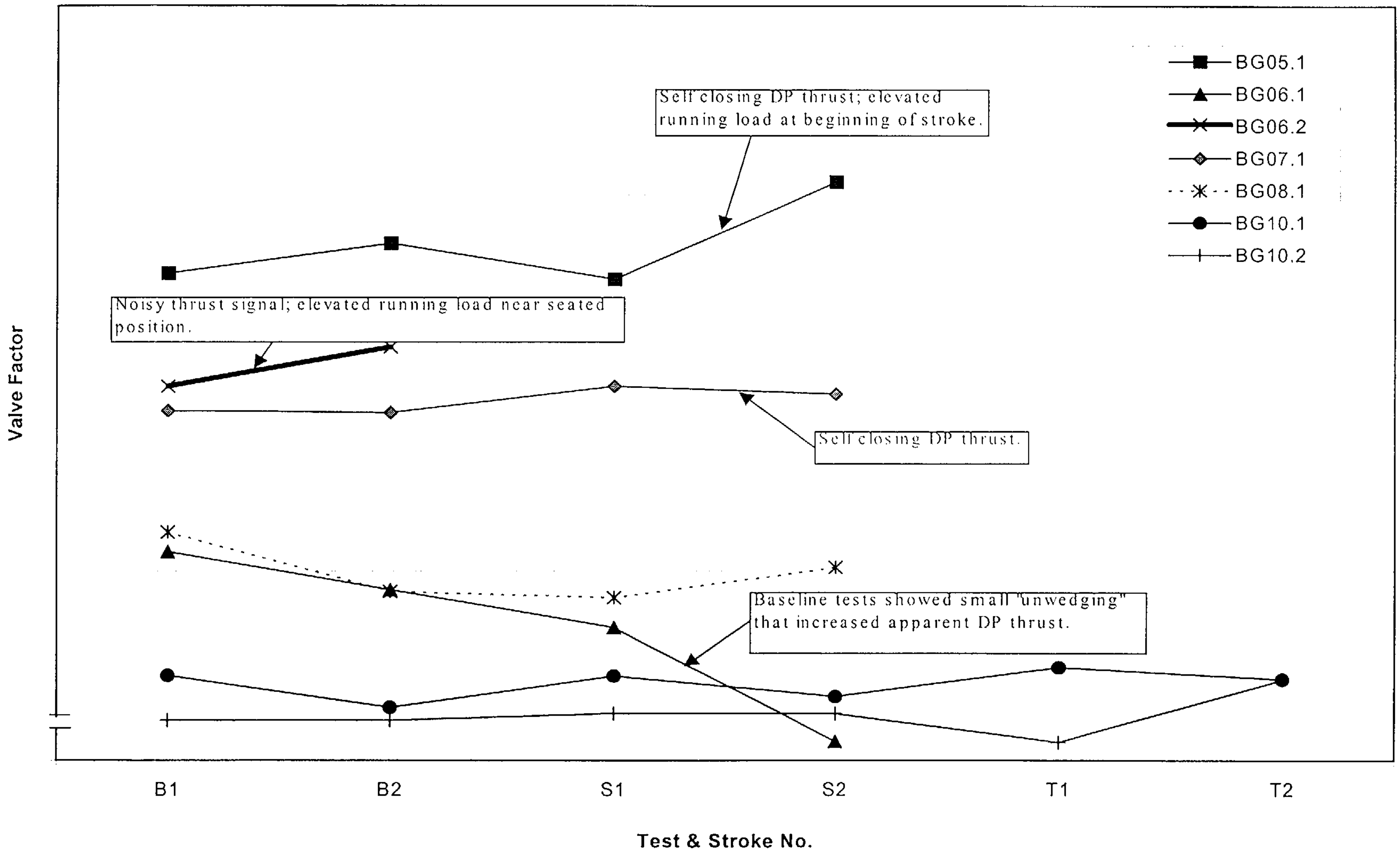
Progression of Valve Factor for Balanced Disk Globe Valves at Unseating



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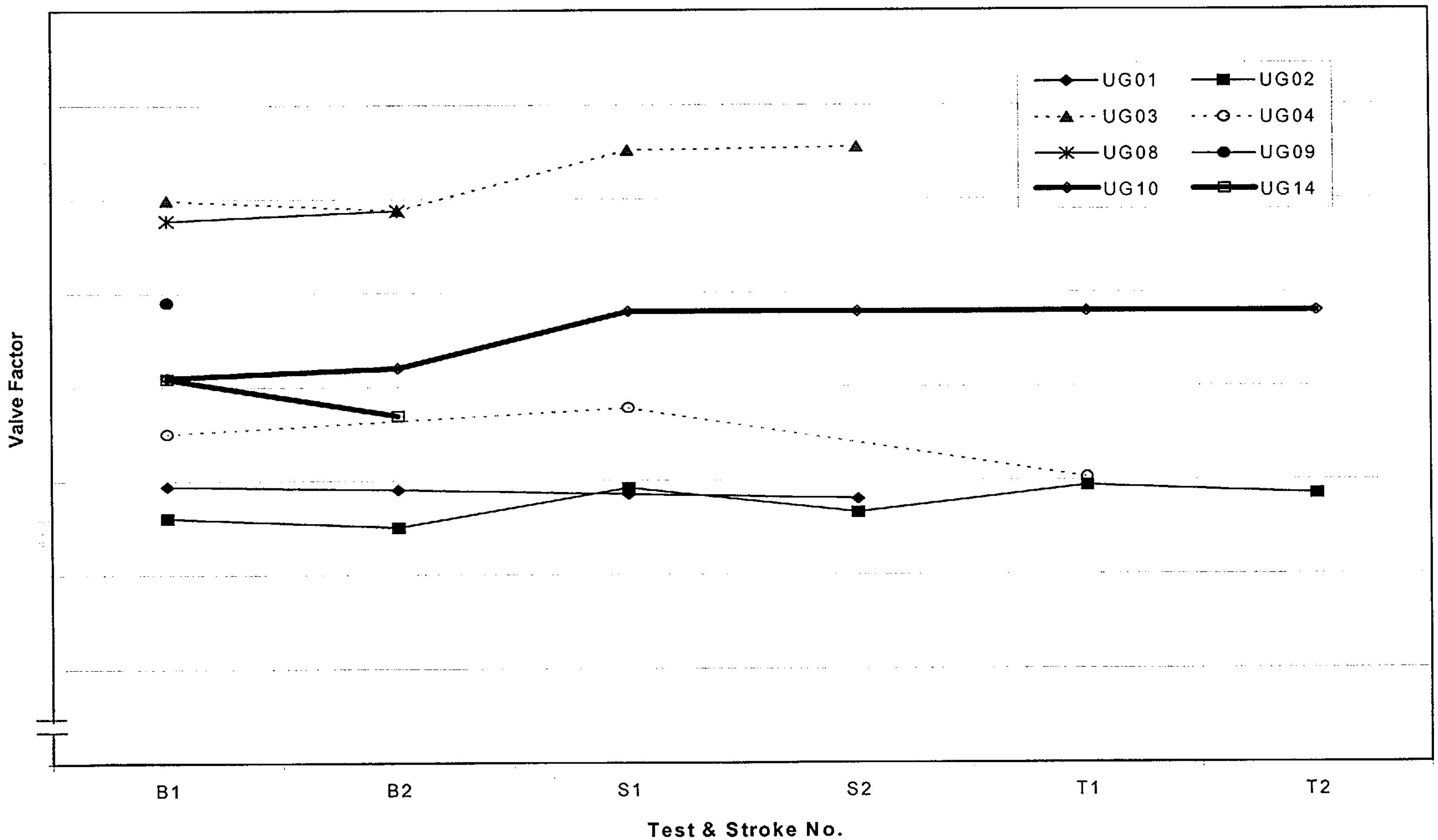
Balanced Disk Globe Valves (cont'd)

- **Planned Actions**
  - Document conclusions based on existing data
  - Close JOG Balanced Disk Globe Valve activities

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)



MPR

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	replaced by B15.2												
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	treated/closed loop water	15	Horizontal	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

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

16-Oct-01

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
B15.2		Atwood & Morrill	8	Bronze	treated/closed loop water	6	3	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

16-Oct-01

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		moved to BG06.2						
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

16-Oct-01

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

Configuration of JOG PV Program Balanced Disk Globe Valves

JOG Test Matrix No	Manufacturer	Size (inches)	Pressure Class (lbs)	Disk Guide Surface Material	Body Guide Surface Material	Mean seat diameter (in)	Stem Orientation	Normal Position	Flow Direction	Fluid	Normal Fluid Temperature (F)	Total Strokes Per Year	Strokes Per Year with Flow and DP
BG01.1	Fisher Controls	4	900	Stellite	17-4 PH	3.529	vert	open	overseat	treated water	70	100	75
BG05.1	Fisher Controls	4	300	300 series SS	400 series SS	4.375	vert	open	underseat	treated water	120	12	6
BG06.1	Copes-Vulcan	10	150	400 series SS	400 series SS	10.453	horz	closed	underseat	untreated water	80	6	1
BG06.2	CCI	8	300	410 SS	300 series SS	6.88	vert	closed	overseat	treated water	100	12	2
BG07.1	Valtek	10	900	316 SS	Bronze	5.875	vert	closed	underseat	treated water	68	14	4
BG08.1	CCI	2	900	410 SS	Carbon steel	1.491	vert	open	overseat	treated water	68	20	0
BG10.1	Copes-Vulcan	12	150	17-4 PH	SS	11.9	vert	closed	underseat	untreated water	85	4	4
BG10.2	Copes-Vulcan	16	150	17-4 PH	SS	13.6	vert	closed	underseat	untreated water	85	4	4

Test Information for JOG PV Program Balanced Disk Globe Valves

JOG Test Matrix No	Flow Direction	Closing VF? (DP thrust resists closing)	Opening VF? (DP thrust resists opening)	Flow rate (ft/sec based on pipe D)	Flow rate (ft/sec based on seat D)	Closing Test DP (psig)	Open Test DP (psig)	Test Temperature (deg F)	Maximum DP Thrust (lb)	Notes
BG01.1	overseat	Yes		13.7	17.5	1784 - 1920	1523 - 1720	71 - 83	824	In closing direction, max thrust occurs at running because of high stem rejection (high downstream pressure). No VF calculation @ max thrust.
BG05.1	underseat		Yes	44.4	37.1	210 - 223	208 - 242	87 - 94	1116	Small amount of "DP thrust" may be due to running load being higher at start of opening stroke.
BG06.1	underseat	Yes	Yes	10.8	9.9	99 - 103	93 - 96	49 - 61	906	On second test, closing DP stroke seating region is "rounded" rather than sharp as in baseline test, and no valid VFs are determined. Opening strokes show a small "unwedging" that increases the open DP thrust (more prevalent in baseline test than in second test).
BG06.2	overseat	Yes	Yes	19.1	25.9	216	189	85	1573	Thrust signal is very noisy, which makes selection of the DP thrust imprecise. Also, the running load is higher near the seated position, which increases the DP thrust.
BG07.1	underseat		Yes	19.8	57.4	1376 - 1523	1341 - 1433	87	7688	Large stem rejection load (~10,000 lb) due to 3-inch stem @ 1400 psi. Valve is stroked from partial (throttled) position; VF cannot be calculated using JOG formula that references running load. Instead, thrusts in DP tests compared to static tests to determine VF.
BG08.1	overseat	Yes	Yes	48.0	86.4	657 - 677	632 - 657	78 - 80	138	DP thrusts are extremely small. Although traces are clear, the key points cannot be identified with precision because of the small thrust changes.
BG10.1	underseat	Yes	Yes	17.7	18.0	85 - 117	84 - 115	54 - 75	626	Opening stroke (baseline test) showed an increase in thrust after unseating. Opening stroke (3rd test) showed a small "unwedging" which increased the DP thrust. Closing stroke (2nd test) seating region is "rounded" rather than sharp as in baseline and 3rd tests, and no valid VFs are determined.
BG10.2	underseat	Yes	Yes	13.1	18.1	103 - 111	101 - 109	52 - 80	675	Opening stroke (baseline test) has max thrust in a noisy region and may not be accurate. Opening stroke (3rd test) has thrust excursion after DP thrust abates.

AGENDA

NRC/JOG PUBLIC MEETING

MOTOR-OPERATED VALVE PROGRAM ON PERIODIC VERIFICATION

October 17, 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) - Issuance of RIS 2001-15 on dc motor performance issuance
11:45 a.m.	Action Items and Schedule for Next Meeting (NRC and JOG)
Noon	Closing (NRC)

NRC STAFF REVIEW OF LICENSEE PROGRAMS ESTABLISHED IN RESPONSE TO GENERIC LETTERS 89-10 AND 96-05

(October 17, 2001)

NRC staff has completed its review of motor-operated valve (MOV) programs established at all active reactor units in response to GL 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance."

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 all 103 active reactor units.

DC-POWERED MOV OUTPUT ISSUE

NRC Information Notice (IN) 96-48, "Motor-Operated Valve Performance Issues," and its Supplement 1 (July 24, 1998), alerted licensees to updated guidance for predicting ac-powered MOV output and identified initial efforts to evaluate prediction method for dc-powered MOV output.

NUREG/CR-6620 (May 1999), "Testing of dc-Powered Actuators for Motor-Operated Valves," provided results of program sponsored by NRC Office of Nuclear Regulatory Research (RES) and conducted at Idaho National Engineering and Environmental Laboratory (INEEL) that identified concerns regarding dc-powered MOV output.

The Boiling Water Reactors Owners' Group (BWROG) developed updated methodology for predicting dc-powered MOV performance and stroke time, including consideration of degraded voltage, ambient temperature effects, motor heatup, and gearbox efficiency.

On June 23, 2000, BWROG forwarded Topical Report NEDC-32958 (March 2000), "BWR Owners' Group DC Motor Performance Methodology - Predicting Capability and Stroke Time in DC Motor-Operated Valves," to NRC staff for information.

On August 30, 2000, NRC staff held public meeting with BWROG to discuss dc-motor performance methodology.

In a letter dated October 2, 2000, BWROG provided recommended utility implementation schedule of 12 months or first refueling outage (whichever later) for first priority MOVs, and two refueling outages for second priority MOVs. First priority defined as dc-powered GL 96-05 MOVs with static test frequency of two cycles or less in JOG program. Second priority includes remaining dc-powered GL 96-05 MOVs. BWROG established start date for implementation schedule as date on which NRC acknowledged that methodology is acceptable.

As part of GL 96-05 review, NRC staff discussed with licensees the prediction of dc-powered MOV performance, and verified that licensees were aware of BWROG initiative. The staff indicated ongoing efforts regarding dc-powered MOV output performance in safety evaluations prepared to close GL 96-05 reviews at individual nuclear plants.

DC-POWERED MOV OUTPUT ISSUE
(CONTINUED)

NRC staff conducted sample review of BWROG methodology with assistance from RES and INEEL to support preparation of Regulatory Issue Summary (RIS) to resolve issue of prediction of dc-powered MOV output.

BWROG methodology used best available information for some aspects of dc-powered MOV performance that could be refined in the future. Possible areas of improvement of the BWROG methodology include (1) supplementing best available data used in development of methodology with additional information, such as dc-motor performance data for those motors without specific data to strengthen use of vendor curves; (2) comparison to MOV performance from additional operational data that challenges the MOV capability earlier in the valve stroke; (3) consideration of significant temperature rise predicted by methodology in comparison to actual experience, effects on output, and vendor qualification limits; and (4) clarification of prediction of gearbox efficiency in terms of potential for values below pullout value.

On August 1, 2001, NRC staff issued RIS 2001-15, "Performance of DC-Powered Motor-Operated Valve Actuators," that informs licensees of availability of improved industry guidance for predicting performance of dc-powered MOV actuators. Based on sample review, BWROG methodology represents a reasonable approach in improvement of past industry guidance for predicting stroke time and output of dc-powered MOV actuators. BWROG methodology applicable to BWRs and PWRs because of similarity in the design and application of dc-powered MOVs. With the new BWROG methodology available, the staff considers regulatory issue of adequate prediction of performance of safety-related dc-powered MOV actuators can be effectively resolved through implementation of improved industry guidance.

NRC staff continues to monitor long-term MOV periodic verification programs being implemented by licensees in response to GL 96-05.