

NELES

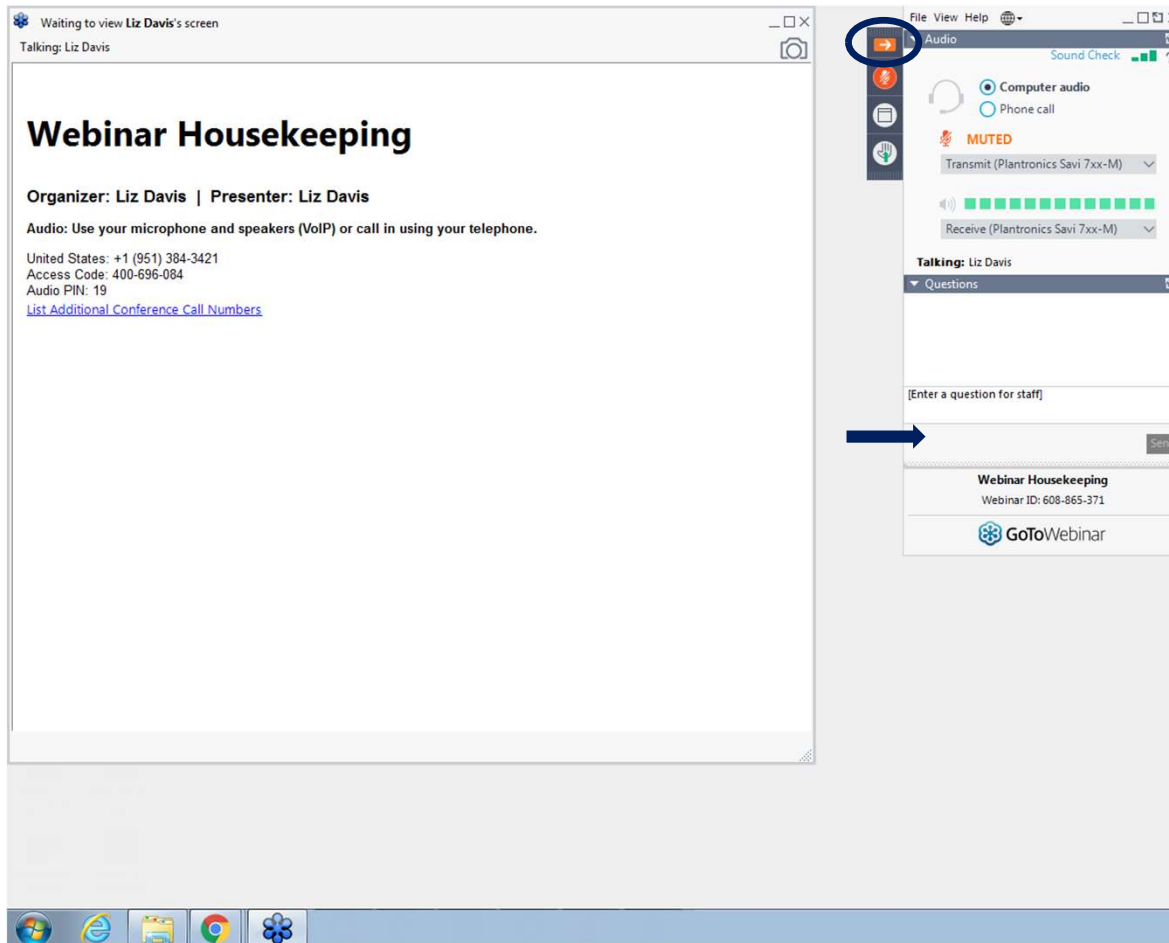
Product school

Sizing Control Valves in Nelprof

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In session features

NELES



If experiencing audio issues please let us know in question field.

Introductions

Presenter / Moderator / Panelist / Guest speaker

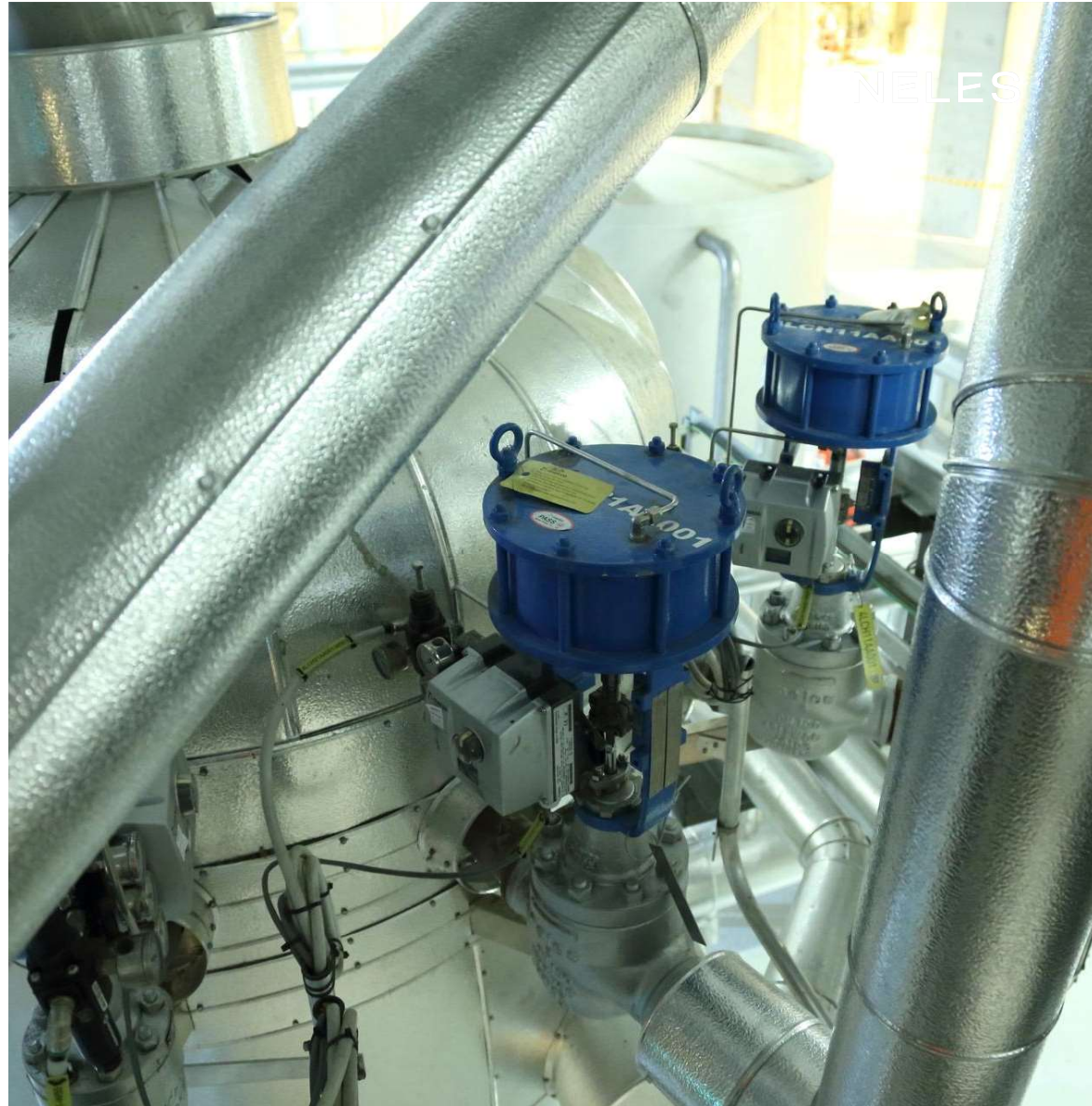
- Steven Hocurscak
- Control Valve Product Manager
- With the company for 15 years, predominately involved with control valves.



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Agenda

- In this training we will be looking at the Nelprof program in greater detail than in our example-based training.

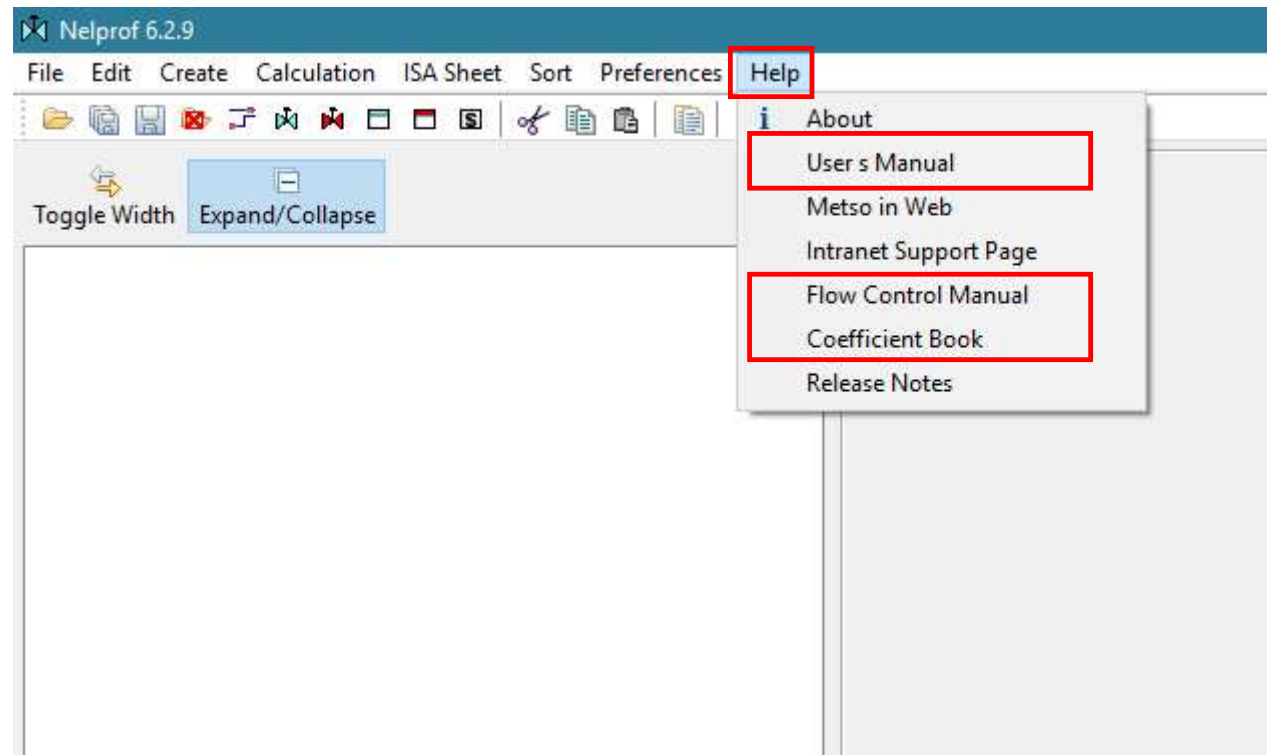


General Nelprof Information

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Important Literature

- Inside Nelprof click on "Help" and select:
 - User Manual
 - Flow Control Manual
 - Coefficient Book



General Nelprof Information

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Areas of a Control Valve Sizing

- Media Properties
 - Water / Steam will automatically fill in required information
 - Liquid / Gas requires more information
- Pipeline
 - Pipe schedule affects noise levels
- Flow Data
 - Enter process data here, and valve data below

Control ☐ Notes and warnings ☐ Characteristics Curves ☐ Comparison

 Liquid

 Water

 Pulp

 Gas

 Steam

 2-phase

L spec grav

Density lb/ft3

Crit press psiA

Viscosity cp

Sound vel ft/s 1400

Special servi Normal

Dpm-factor

Design P psiG

DesignTmax degF

DesignTmin degF

Pipeline	Unit	Inlet dia	Outlet dia	Thickness	Schedule
		in			40

Flow data	Unit	Case 1	Case 2	Case 3	Case 4
Liq flow	gpm				
Inlet temp	degF				
Inlet press	psiG				
Press diff	psi				
Outlet press	psiG				
Vap press	psiA				
DP-shutoff	psi				

Valve...	Unit	Type	Press rating	Code	Size
	in	ALL	ALL ANSI		AUTOM

Results	Unit	Case 1	Case 2	Case 3	Case 4
Max capacity	FpCv				
Req capacity	FpCv				
Travel	%				
Opening	deg				
Noise	dba[VDMA]				
Flow velocity	ft/s				
Terminal dp	psi				
FI coeff.					

☒ Actuator sizing

Construction	Material	Seal	Gland pack	Bearings	Safety factor
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General Sizing Example

General Sizing Example1

Sizing Example

- Media: Water
- Valve: 1.5" RE
- Class: 150#
- Actuator: Diaphragm
- Fail: Close
- Supply: 60 psi

Pipeline	Unit	Inlet dia	Outlet dia	Thickness	Schedule
	in	2	2		40
Flow data	Unit	Case 1	Case 2	Case 3	Case 4
Liq flow	gpm	100	150		
Inlet temp	degF	72	72		
Inlet press	psiA	140	120		
Press diff	psi	70	50		
Outlet press	psiA	70	70		
Vap press	psiA	0.491	0.491		
DP-shutoff	psi	140			

General Sizing Example

Valve Results

- Max capacity: Maximum flow capacity of the chosen control valve. $F_p C_v$ will take into account piping reducers.
- Req capacity: Calculated capacity needed for flow conditions specified in the same column.
- Travel: Opening as a percentage of full travel, excluding initial opening (dead angle). The initial opening is the travel before the flow starts.
- Opening: Opening in degrees for rotary valves, including initial opening (dead angle).
- Noise: Predicted sound pressure level based on the VDMA 24422 (May 1979) or enhanced IEC 60534-8-4 standard.

Results	Unit	Case 1	Case 2	Case 3	Case 4
Max capacity	Cv	110			
Req capacity	Cv	12.0	21.4		
Travel	%	41.4	55.5		
Opening	deg	46.3	58		
Noise	dBA [VDMA]	72	70		
Flow velocity	ft/s	16.47	24.71		
Terminal dp	psi	106.13	80.23		
FI coeff.		0.88	0.83		

General Sizing Example

Valve Results

- **Flow Velocity:** Flow velocity at the valve inlet (liquids) and valve outlet (gases / vapors)
- **Terminal dP:** Often referred to as Critical pressure drop. Whenever the differential pressure is higher than the terminal pressure drop the valve will experience high intensities of cavitation.
- **F_L Coefficient:** The pressure recovery factor of the valve with this particular opening.

Results	Unit	Case 1	Case 2	Case 3	Case 4
Max capacity	Cv	110			
Req capacity	Cv	12.0	21.4		
Travel	%	41.4	55.5		
Opening	deg	46.3	58		
Noise	dBA [VDMA]	72	70		
Flow velocity	ft/s	16.47	24.71		
Terminal dp	psi	106.13	80.23		
F_L coeff.		0.88	0.83		

General Sizing Example

Valve Results

- **Torque to Open:** Torque required to begin opening the valve. Calculated with dp Shutoff. Equals to BTO (break to open) torque with On-off calculation.
- **Torque to Close:** Torque required to fully close the valve. Calculated with dp Shutoff. Equals to ETC (end to close) torque with On-off calculation.

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Actuator...	Code	Size	Unit	Supply press	Spring rate
	QP	AUTOM	psiG	60	
Torques					
To open	ftlb	8	To close	ftlb	7
Opening LF	%	17	Closing LF	%	26
Control open	ftlb	6		6	
Ctrl open LF	%	11		13	
Control close	ftlb	6		6	
Control close LF	%	11		10	

Actuator...	Code	Size	Unit	Supply press	Spring rate
	QP	AUTOM	psiG	60	
Torques					
To open	ftlb	8	To close	ftlb	7
Opening LF	%	17	Closing LF	%	26
Control open	ftlb	6		6	
Ctrl open LF	%	11		13	
Control close	ftlb	6		6	
Control close LF	%	11		10	

General Sizing Example

Valve Results

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- **Control Open:** Torque required in modulating the control when increasing opening. Equals the friction torque + dynamic torque. Calculated with control flow conditions.
- **Control Close:** Torque required in modulating the control when decreasing opening. Equals the friction torque - dynamic torque. Calculated with control flow conditions.

Actuator...	Code	Size	Unit	Supply press	Spring rate	
	QP	AUTOM	psiG	60		
Torques						
To open		ftlb	8	To close	ftlb	7
Opening LF	%		17	Closing LF	%	26
Control open	ftlb		6	6		
Ctrl open LF	%		11	13		
Control close	ftlb		6	6		
Control close LF	%		11	10		

Actuator...	Code	Size	Unit	Supply press	Spring rate	
	QP	AUTOM	psiG	60		
Torques						
To open		ftlb	8	To close	ftlb	7
Opening LF	%		17	Closing LF	%	26
Control open	ftlb		6	6		
Ctrl open LF	%		11	13		
Control close	ftlb		6	6		
Control close LF	%		11	10		

General Sizing Example

Valve Results

- Opening / Closing LF: Opening / Closing Load Factor.
 - Load factor is the required torque divided by the available torque.
 - A value of 17 means that 17% of the available actuator output torque is required to open the valve.
 - Opening / Closing LF should be below 90

Actuator...	Code	Size	Unit	Supply press	Spring rate	
	QP	AUTOM	psiG	60		
Torques						
To open		ftlb	8	To close	ftlb	7
Opening LF	%		17	Closing LF	%	26
Control open	ftlb		6		6	
Ctrl open LF	%		11		13	
Control close	ftlb		6		6	
Control close LF	%		11		10	

General Sizing Example

Valve Results

- Control __ LF: Control Open / Control Close Load Factor.
 - Load factor is the required torque divided by the available torque.
 - A value of 11 means that 11% of the available actuator output torque is required to open the valve.
- Control LF should be below 60

Actuator...	Code	Size	Unit	Supply press	Spring rate	
	QP	AUTOM	psiG	60		
Torques						
To open		ftlb	8	To close	ftlb	7
Opening LF	%		17	Closing LF	%	26
Control open	ftlb		6	6		
Ctrl open LF	%		11	13		
Control close	ftlb		6	6		
Control close LF	%		11	10		

General Sizing Example

Valve Results

- Actuator available torque = Required Torque / Load Factor
 - Example: $8 / 0.17 = 47$ ft lbs
 - $47 * .17 = 8$
- Safety Factor = $(1 / LF)$
 - Example: $(1 / 0.17) = 5.88$
 - $8 * 5.88 = 47$ ft lbs

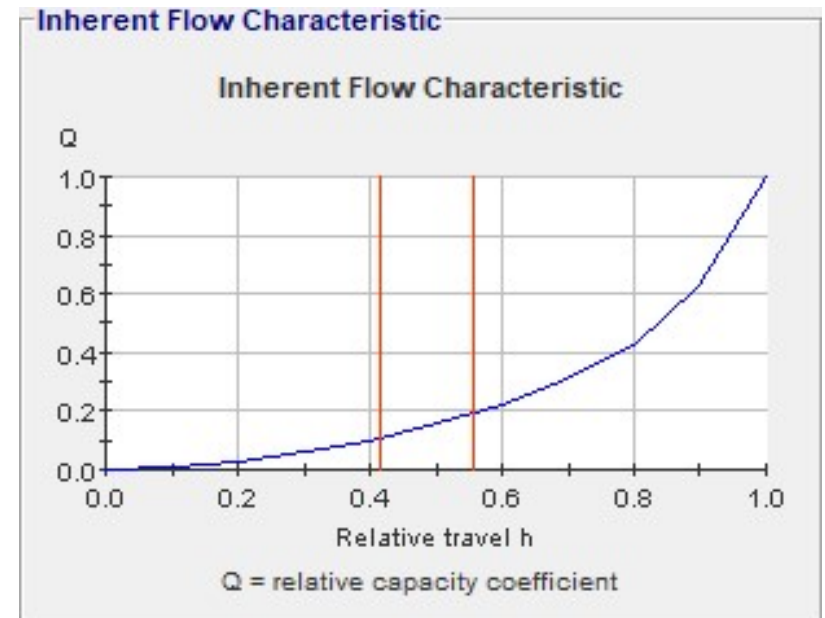
Actuator...	Code	Size	Unit	Supply press	Spring rate	
	QP	AUTOM	psiG	60		
Torques						
To open		ftlb	8	To close	ftlb	7
Opening LF	%		17	Closing LF	%	26
Control open	ftlb		6		6	
Ctrl open LF	%		11		13	
Control close	ftlb		6		6	
Control close LF	%		11		10	

General Nelprof Information

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Characteristic Curves – Inherent Flow Characteristic

- Chart shows a plot of available C_v relative to valve travel.



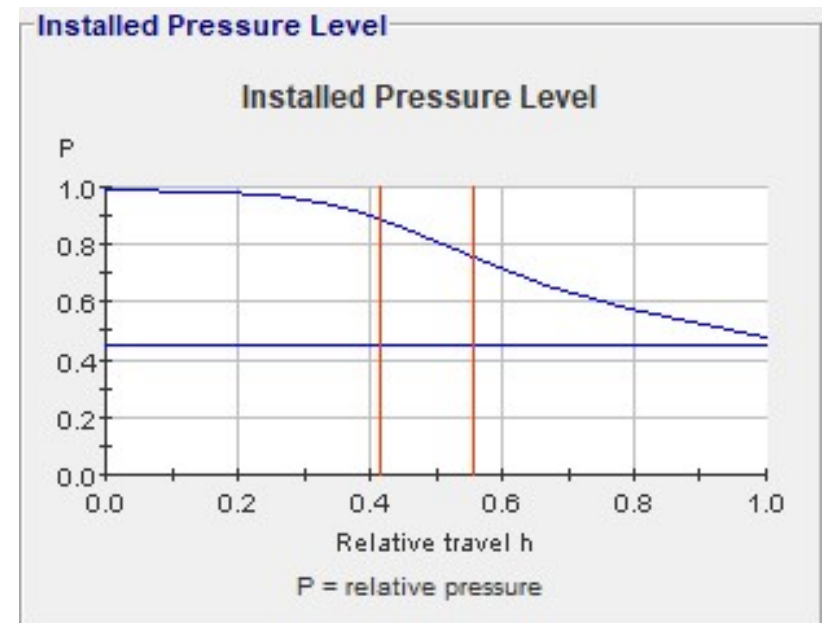
General Nelprof Information

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Characteristic Curves – Installed Pressure Level

Chart plots P1 (top line) and P2 (Bottom Line)

Results	Unit	Case 1	Case 2
Max capacity	Cv	110	
Req capacity	Cv	12.0	21.4
Travel	%	41.4	55.5
Opening	deg	46.3	58
Noise	dB(A) [VDMA]	72	70
Flow velocity	ft/s	16.47	24.71
Terminal dp	psi	106.13	80.23
FI coeff.		0.88	0.83
Flow data	Unit	Case 1	Case 2
Liq flow	gpm	100	150
Inlet temp	degF	72	72
Inlet press	psiA	140	120
Press diff	psi	70	50
Outlet press	psiA	70	70
Vap press	psiA	0.491	0.491
DP-shutoff	psi	140	

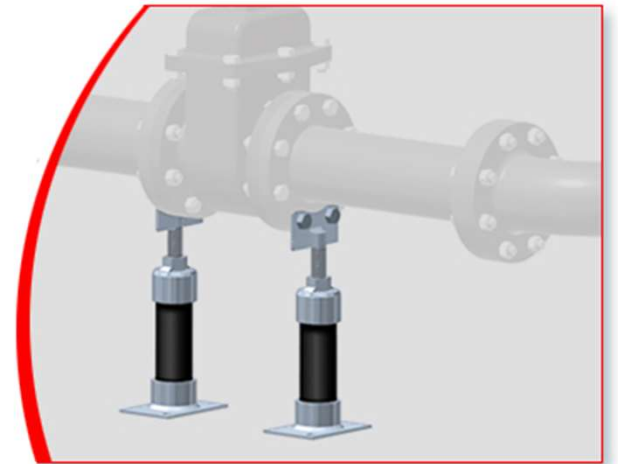


$\frac{1}{2}$ Pipe Size Rule

General Sizing Example

½ Pipe Size Rule

- When the valves sized is less than ½ the pipe size, you have a few options
 - Select a valve with less Cv (less to more)
 - Globe
 - Eccentric Plug
 - Butterfly
 - Some valves offer trim reductions like Eccentric Plug and Globe valves
 - Though costly, you can add Q-Trim to a valve since it has less capacity.
 - Installing a valve smaller than ½ the pipe size is possible, though we would strongly recommend piping supports around the valve to prevent piping stresses on the valve flanges



Noise Limits

General Sizing Example

Noise Limits

- Hydrodynamic Noise (Liquids)
 - 85 dBA sizes up to 6" (150 mm)
 - 90 dBA sizes 8"-14" (200-350 mm)
 - 95 dBA sizes 16" (400 mm) and larger
- If valve size is close to next noise level, increase valve size to allow more noise.
- Noise is used to predict cavitation intensity.
 - Since gases do not cavitate, allowable noise levels are different for liquids / gases
- Aerodynamic Noise (Gas / Vapor)
 - OSHA has an 85 dBA limit to avoid hearing damage
 - A noise level higher than 110 dBA will subject the piping and equipment to possible vibrational damage, thus should be avoided.
 - Insulation of pipeline can reduce noise levels by 3-5 dBA / inch. Vibration level does not dampen with insulation!

General Sizing Example 2

Noise Limits

- Media: Saturated Steam
- Valve: RE vs Finetrol
- Class: 300#
- Req: Max Noise Level 95 dBA
- Actuator: Diaphragm
- Fail: Open
- Supply: 60 psi

Pipeline	Unit	Inlet dia	Outlet dia	Thickness	Schedule
	in	4	4		40
Flow data	Unit	Case 1	Case 2	Case 3	Case 4
Gas flow	lb/h	4000	8000	12000	
Inlet temp	degF	421.78	414.18	406.051	
Inlet press	psiG	300	275	250	
Press diff	psi	200	150	100	
Outlet press	psiG	100	125	150	
Inlet density	lb/ft3	0.679	0.626	0.573	
DP-shutoff	psi	300			

General Sizing Example 2

Noise Limits

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☐ Nelprof Control Valve Training

☐ Area

☒ Overview

☐ Example 1 - Basic Sizin

☐ Example 2 - Noise

☐ Example 3 - Velocity

☐ Example 4 - Gain

☐ Example 5 - Gain

☐ Example 6 - FpCv

Spec heats 1.3

Special servi Normal

Dpm-factor 0.5

Design P psiG

DesignTmax degF

DesignTmin degF

☒ Actuator sizing

☐ Recommended safety factor

☐ Resistors Details

Calculate

Result:

Valve RE, 2 in

Actuator QP-SO1C

☐ Expand all

Control Notes and warnings Characteristics Curves Comparison

Pipeline

Unit	Inlet dia	Outlet dia	Thickness	Schedule
in	4	4		40

Flow data

Unit	Case 1	Case 2	Case 3	Case 4
Gas flow lb/h	4000	8000	12000	
Inlet temp degF	421.78	414.18	406.051	
Inlet press psiG	300	275	250	
Press diff psi	200	150	100	
Outlet press psiG	100	125	150	
Inlet density lb/ft3	0.679	0.626	0.573	
DP-shutoff psi	300			

Valve

Unit	Type	Press rating	Code	Size
in	SEGMENT	ANSI 300	RE	2

Results

Unit	Case 1	Case 2	Case 3	Case 4
Max capacity FpCv	103.17			
Req capacity FpCv	8.45	18.7	32.7	
Travel %	26.9	41.8	56.2	
Opening deg	37.8	49.4	60.7	
Noise dBA[VDMA]	96	98	97	
Flow velocity Mach	0.12	0.2	0.26	
Xt coeff.	0.64	0.62	0.58	

Construction

Material	Seat	Gland pack	Bearings	Safety factor
	Metal, Type S	PTFE/TFE	PTFE	1

Actuator

Code	Size	Unit	Supply press	Spring rate
QP-SO	AUTOM	psiG	60	

Torques

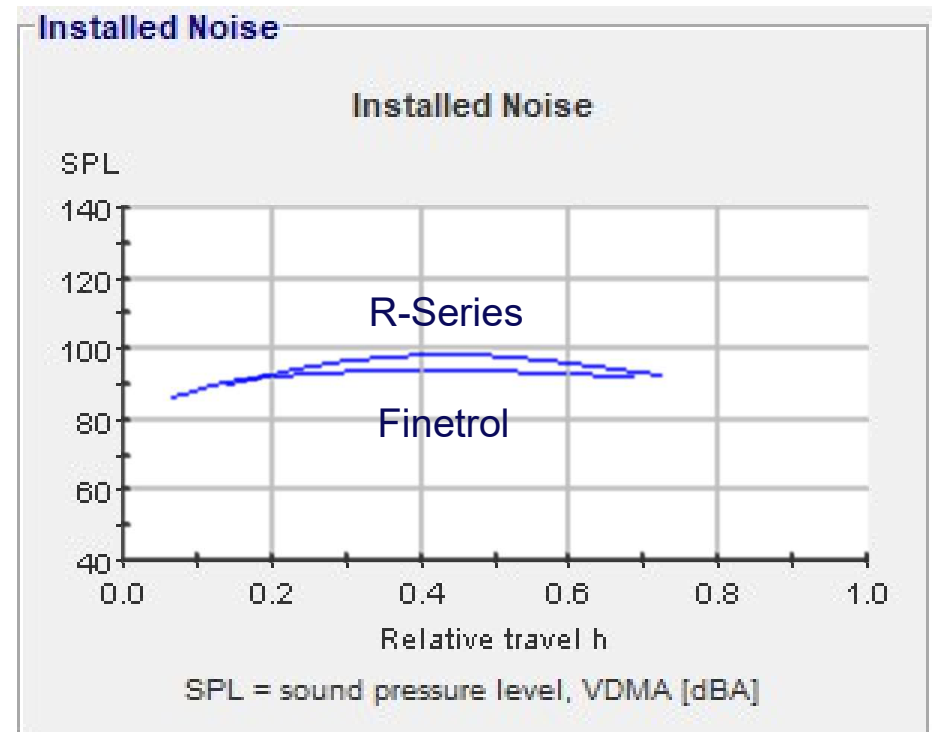
	To open	To close		
Opening LF %	11	Closing LF %	9	
Control open ftlb	22		34	
Ctrl open LF %	8		7	
Control close ftlb	14		16	
Control close LF %	8		7	
Control close LF %	15		12	

General Sizing Example

Noise Limits

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- Finetrol noise level meets the customer's requirements
- There's a lot that goes into a noise generated at the valve, but here is a general order for most to least noisy valves:
 - HPBFV
 - Ball Valve
 - Segment
 - Eccentric Plug
 - Globe



Velocity Limits

General Sizing Example

Velocity

- Liquids:
 - Velocity is measured in ft/s or m/s
 - Continuous duty
 - Butterfly valves 23 ft/s (7 m/s)
 - All other valves 32 ft/s (10 m/s)
 - Infrequent Duty
 - Butterfly valves 27 ft/s (8.5 m/s)
 - All other valves 39 ft/s (12 m/s)
- Gas / Vapors:
 - Mach numbers represent the relationship between the velocity of the media vs the speed of sound
 - 0.5 Mach for continuous control (1/2 the speed of sound)
 - 0.7 Mach for infrequent duty (for example, flaring and venting applications)

General Sizing Example 3

Velocity

- Media: Water
- Valve: 4" RE, Finetrol, Globe
- Class: 300#
- Must stay with 4" valve
- Actuator: Diaphragm
- Fail: Close
- Supply: 60 psi

Pipeline	Unit	Inlet dia	Outlet dia	Thickness	Schedule
	in	6	6		40
Flow data	Unit	Case 1	Case 2	Case 3	Case 4
Liq flow	gpm	370	735	1470	
Inlet temp	degF	60	60	60	
Inlet press	psiG	350	350	350	
Press diff	psi	50	50	50	
Outlet press	psiG	300	300	300	
Vap press	psiA	0.337	0.337	0.337	
DP-shutoff	psi	350			

General Sizing Example 3

Velocity

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☐ Nelprof Control Valve Training

- ☐ Area
 - ☒ Overview
 - ☐ Example 1 - Basic Sizin
 - ☐ Example 2 - Noise
 - ☒ Example 3 - Velocity
 - ☐ RE, 4 in
 - ☐ FI-FTO, 4 in
 - ☐ GB-STD-LIN, 4 in
 - ☐ Example 4 - Gain
 - ☐ Example 5 - Gain
 - ☐ Example 6 - FpCv

☐ Expand all

Control Notes and warnings Characteristics Curves Comparison

Liquid **Water** **Pulp**
Gas **Steam** **2-phase**

Unit

Flow data

Unit	Case 1	Case 2	Case 3	Case 4
Liq flow	gpm	370	735	1470
Inlet temp	degF	60	60	60
Inlet press	psiG	350	350	350
Press diff	psi	50	50	50
Outlet press	psiG	300	300	300
Vap press	psiA	0.337	0.337	0.337
DP-shutoff	psi	350		

Crit press psiA 3208.214
Special servi Normal
Dpm-factor 0.3

Design P psiA
DesignTmax degF
DesignTmin degF

☒ Actuator sizing
☐ Recommended safety factor

☐ Resistors Details

Calculate

Result:
Valve RE, 4 in
Actuator QP2C

Valve...

Unit	Type	Press rating	Code	Size
in	SEGMENT	ANSI 150	RE	4

Results

Unit	Case 1	Case 2	Case 3	Case 4
Max capacity	FpCv	458.12		
Req capacity	Cv	52.5	105	219
Travel	%	36	51.8	73.7
Opening	deg	39.4	53.1	72.1
Noise	dBA [IEC]	55	62	71
Flow velocity	ft/s	9.75	18.37	38.74
Terminal dp	psi	301.66	267.21	221.41
Fl coeff.		0.91	0.86	0.79

Construction

Material	Seat	Gland pack	Bearings	Safety factor
Metal, Type S	PTFE/TFE		Metal	1.2

Actuator...

Code	Size	Unit	Supply press	Spring rate
QP	AUTOM	psiG	60	

Torques

	ftlb	To close	ftlb	
To open	59			47
Opening LF	%	60	Closing LF	%
Control open	ftlb	23		25
Ctrl open LF	%	20		33
Control close	ftlb	22		20
Control close LF	%	20		17

General Sizing Example

Velocity

- Velocity is based on flow and inlet diameter of valve. To estimate inlet velocity, use the following:

$$v = \frac{0.4084q}{d^2}$$

v = velocity (ft/s)

q = flow (gpm)

d = valve inlet ID

- Since velocity is only based on flow and valve ID, we must move valve size up to solve velocity issues.

Valve...	Unit	Type	Press rating	Code	Size
	in	SEGMENT	ANSI 150	RE	4
Results	Unit	Case 1	Case 2	Case 3	Case 4
Max capacity	FpCv	458.12			
Req capacity	Cv	52.5	105	219	
Travel	%	36	51.8	73.7	
Opening	deg	39.4	53.1	72.1	
Noise	dBa [IEC]	55	62	71	
Flow velocity	ft/s	9.75	19.37	38.74	
Terminal dp	psi	301.66	267.21	221.41	
FI coeff.		0.91	0.86	0.79	
Valve...	Unit	Type	Press rating	Code	Size
	in	ROTARY	ANSI 150	FI-FTO	4
Results	Unit	Case 1	Case 2	Case 3	Case 4
Max capacity	FpCv	225.47			
Req capacity	Cv	52.5	105	218	
Travel	%	31.1	56.8	93.8	
Opening	deg	28	51.1	84.4	
Noise	dBa [IEC]	59	65	69	
Flow velocity	ft/s	9.75	19.37	38.74	
Terminal dp	psi	274.97	245.72	210.87	
FI coeff.		0.87	0.83	0.77	
Valve...	Unit	Type	Press rating	Code	Size
	in	GLOBE	ANSI 150	GB-STD-LIN	4
Results	Unit	Case 1	Case 2	Case 3	Case 4
Max capacity	FpCv	217.87			
Req capacity	Cv	52.5	105	218	
Travel	%	23.4	40	89.3	
% of max cap.	%	N/A	N/A	N/A	
Noise	dBa [IEC]	63	70	77	
Flow velocity	ft/s	9.75	19.37	38.74	
Terminal dp	psi	262.49	253.48	237.18	
FI coeff.		0.85	0.84	0.82	

Opening Angles

General Sizing Example

Opening Angles

- Minimum Flows:
 - Ball, Segment, Rotary Globe and Finetrol can control down to 5% open.
 - Butterfly valves keep above 10%
 - Globe valves keep above 15%
- All minimum opening angles below 20% cannot be a normal flow that the valve will see normally. The valve can handle a startup case that is seen a few times a year, but the valve should not see that flow case regularly.
- Normal / Max Flows:
 - Ball, Segment, Rotary Globe, and Finetrol valves 20%-90%
 - Butterfly and Globes are 20%-80%

Gain

General Sizing Example 4

Sizing Example - Installed Flow Characteristics & Gain

- Media: Liquid / SG: 1.05
- Valve: 4" RE vs Finetrol
- Class: 300#
- Actuator: Piston
- Fail: Close
- Supply: 60 psi

Pipeline	Unit	Inlet dia	Outlet dia	Thickness	Schedule
	in	6	6		40

Flow data	Unit	Case 1	Case 2	Case 3	Case 4
Liq flow	ton/day	2000	4000	6000	6570
Inlet temp	degF	60	60	60	60
Inlet press	psiG	350	350	350	350
Press diff	psi	50	50	50	50
Outlet press	psiG	300	300	300	300
Vap press	psiA	0.4	0.4	0.4	0.4
DP-shutoff	psi	350			

General Sizing Example 4

Sizing Example - Installed Flow Characteristics & Gain

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☐ Nelprof Control Valve Training

- ☐ Area
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 - ☐ Example 1 - Basic Sizing
 - ☐ Example 2 - Noise
 - ☐ Example 3 - Velocity
 - ☒ Example 4 - Gain
 - ☐ R-series
 - ☐ Finetrol 4"
 - ☐ Finetrol 6"
 - ☐ Example 5 - Gain
 - ☐ Example 6 - FpCv

L spec grav 1.05
Density lb/ft³
Crnt press psiA 3208.214
Viscosity cp
Sound vel ft/s 1400
Special servi Normal
Dpm-factor 0.3

Design P psiA
DesignTmax degF
DesignTmin degF

☒ Actuator sizing
☐ Recommended safety factor

☐ Resistors Details

Calculate

Result:
Valve RE, 4 in
Actuator B1J8

☐ Expand all

Control Notes and warnings Characteristics Curves Comparison

Pipeline

Unit	Inlet dia	Outlet dia	Thickness	Schedule
in	6	6		40

Flow data

Unit	Case 1	Case 2	Case 3	Case 4
Liq flow ton/day	2000	4000	6000	6570
Inlet temp degF	60	60	60	60
Inlet press psiG	350	350	350	350
Press diff psi	50	50	50	50
Outlet press psiG	300	300	300	300
Vap press psiA	0.4	0.4	0.4	0.4
DP-shutoff psi	350			

Valve...

Unit	Type	Press rating	Code	Size
in	SEGMENT	ANSI 300	RE	
				4

Results

Unit	Case 1	Case 2	Case 3	Case 4
Max capacity FpCv	458.12			
Req capacity Cv	50.9	103	156	172
Travel %	35.4	51.2	63	66
Opening deg	38.8	52.6	62.9	65.5
Noise dBA [IEC]	54	61	66	68
Flow velocity ft/s	9.23	18.46	27.68	30.31
Terminal dp psi	302.93	268.37	242.66	235.41
FI coeff.	0.91	0.86	0.82	0.81

Construction

Material	Seat	Gland pack	Bearings	Safety factor
Metal, Type S		PTFE/TFE	PTFE	
				1.2

Actuator...

Code	Size	Unit	Supply press	Spring rate
	B1J	AUTOM	psiG	
				60

Torques

	ftlb	To close	ftlb		
To open		40			32
Opening LF %		42	Closing LF %		57
Control open	20		20	21	21
Ctrl open LF %		28		30	31
Control close	19		19	18	18
Control close LF %		34		26	25

General Sizing Example

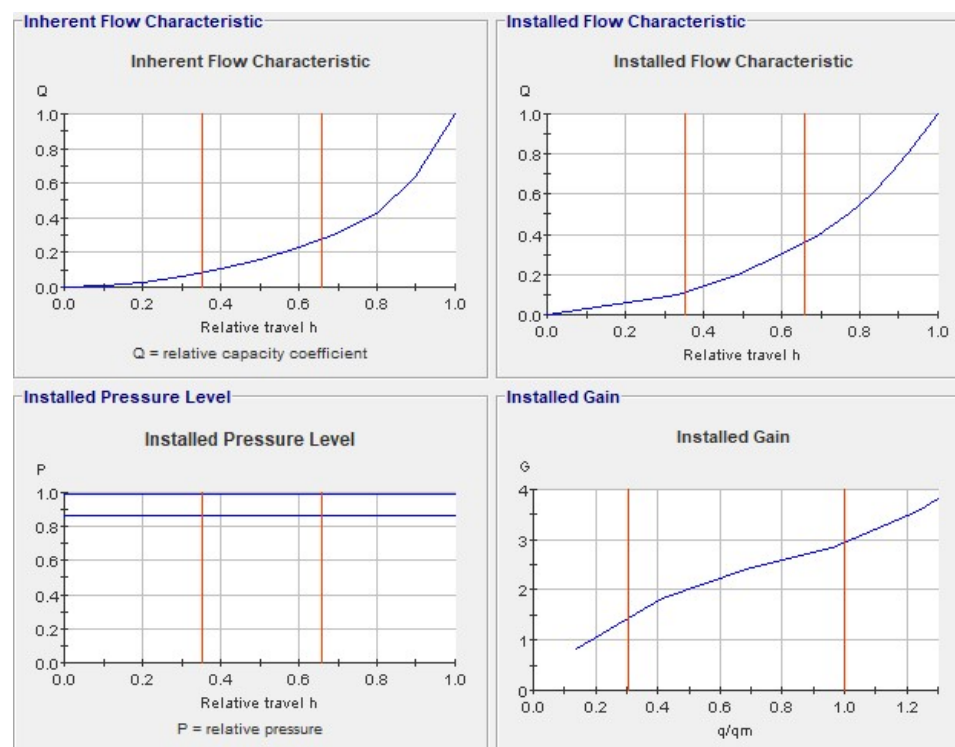
NELES

Sizing Example - Installed Flow Characteristics & Gain

- Sizing an R-Series valve for this applications produced a poor gain curve
- A Gain curve that starts low and climbs high often happens when you install an E% valve into a linear application

Pipeline	Unit	Inlet dia	Outlet dia	Thickness	Schedule
	in	6	6		40

Flow data	Unit	Case 1	Case 2	Case 3	Case 4
Liq flow	ton/day	2000	4000	6000	6570
Inlet temp	degF	60	60	60	60
Inlet press	psiG	350	350	350	350
Press diff	psi	50	50	50	50
Outlet press	psiG	300	300	300	300
Vap press	psiA	0.4	0.4	0.4	0.4
DP-shutoff	psi	350			



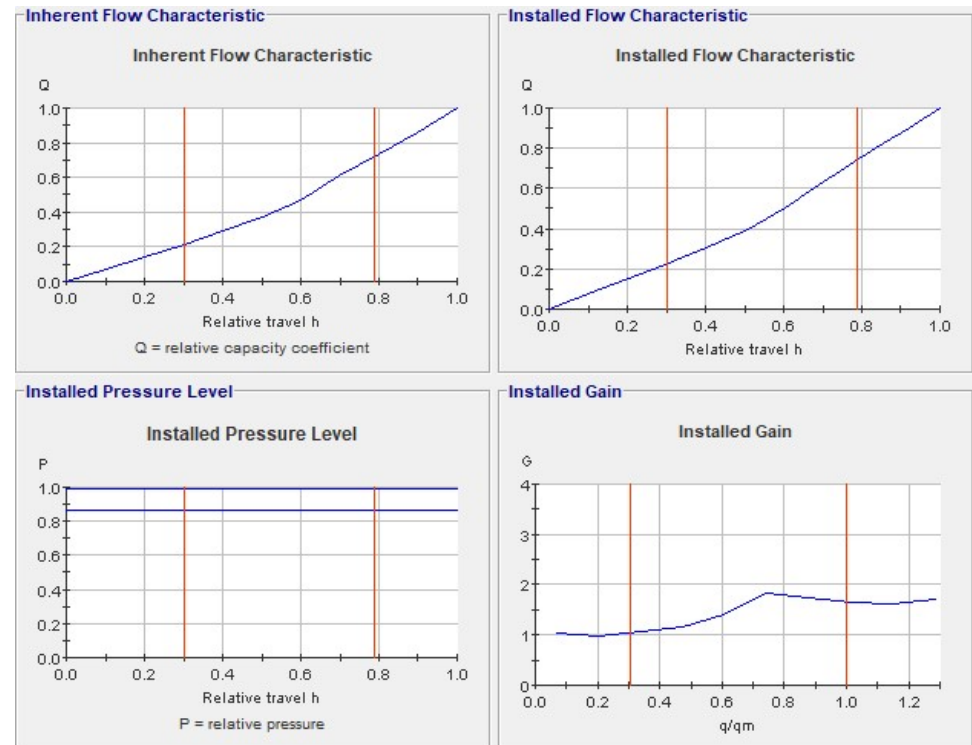
General Sizing Example

NELES

Sizing Example - Installed Flow Characteristics & Gain

- Sizing a Finetrol produces a better gain curve
- Process is linear when P1 and P2 are constant over all flow cases

Pipeline	Unit	Inlet dia	Outlet dia	Thickness	Schedule
	in	6	6		40
Flow data	Unit	Case 1	Case 2	Case 3	Case 4
Liq flow	ton/day	2000	4000	6000	6570
Inlet temp	degF	60	60	60	60
Inlet press	psiG	350	350	350	350
Press diff	psi	50	50	50	50
Outlet press	psiG	300	300	300	300
Vap press	psiA	0.4	0.4	0.4	0.4
DP-shutoff	psi	350			

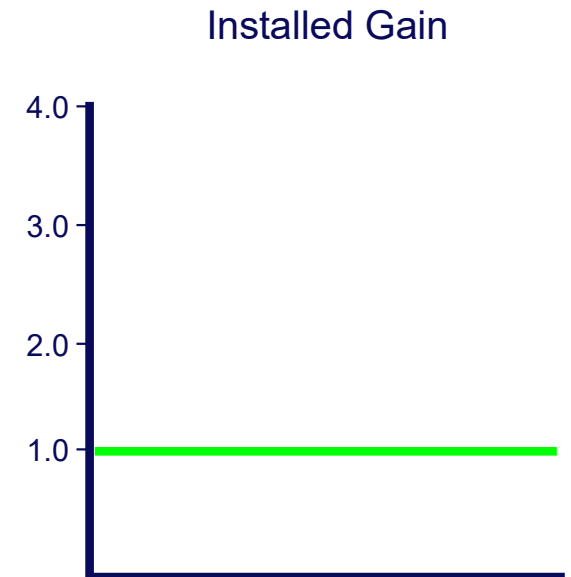
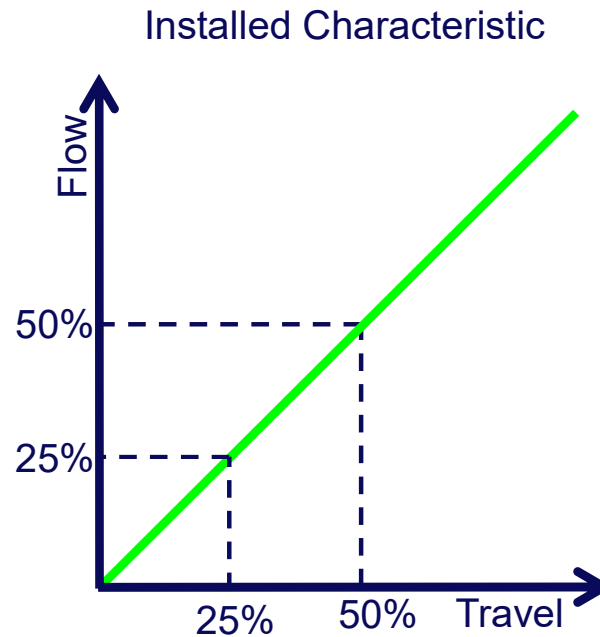


General Sizing Example

Sizing Example - Installed Flow Characteristics & Gain

- A graphical interpretation of GAIN is the SLOPE of the installed characteristic.

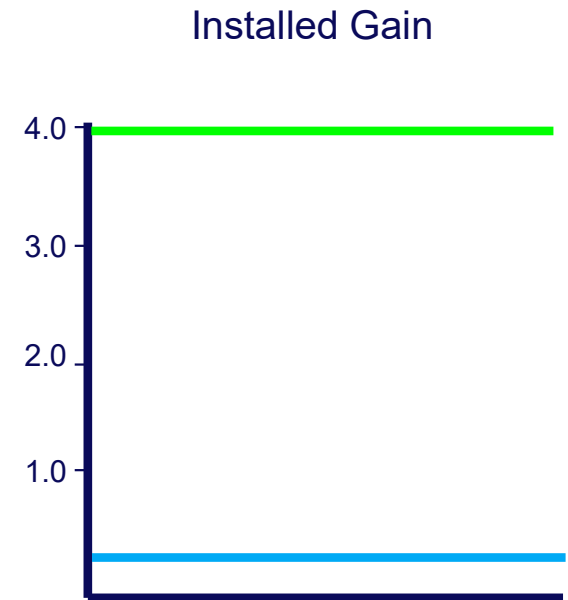
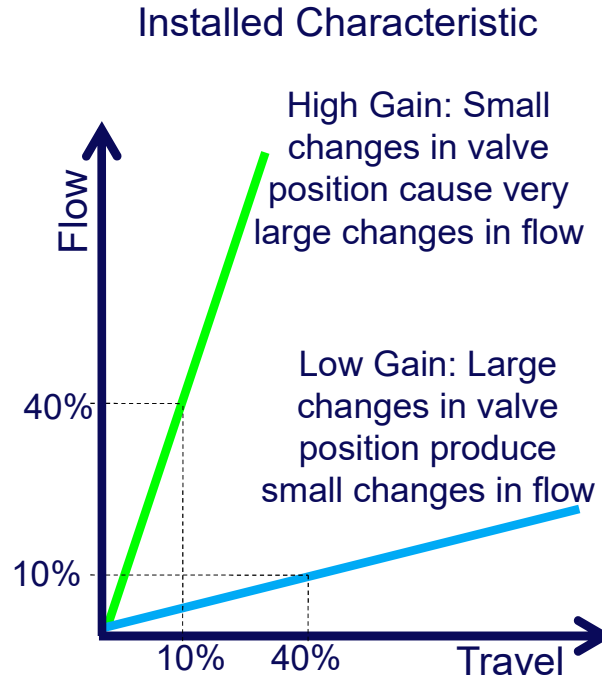
$$G = \frac{dQ_P}{dh}$$



General Sizing Example

Sizing Example - Installed Flow Characteristics & Gain

- Here we have two valves with straight line installed characteristics, one with a very steep slope and one with a very shallow slope.

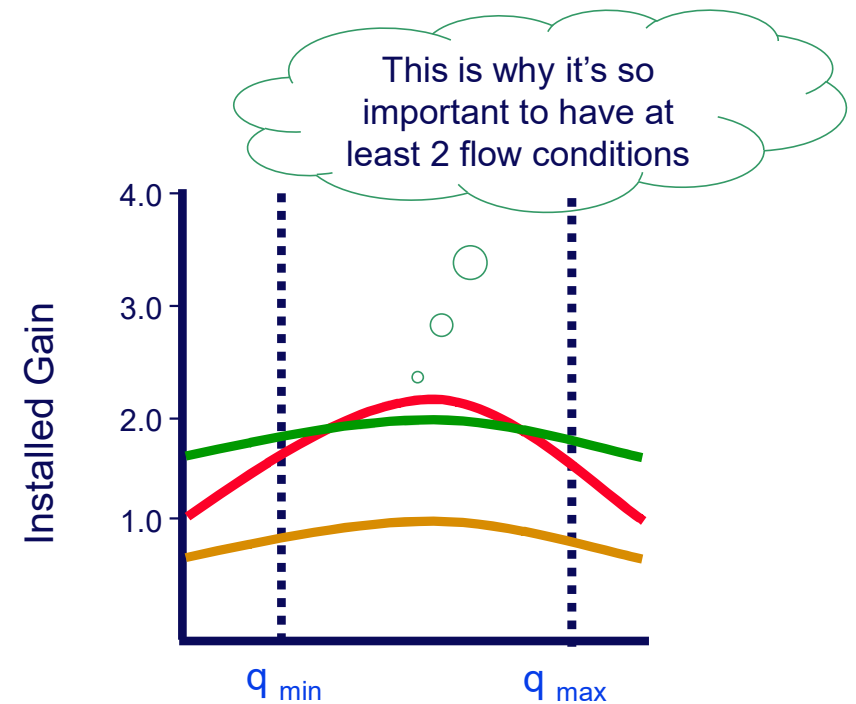


General Sizing Example

Sizing Example - Installed Flow Characteristics & Gain

Within the specified control range:

1. $\text{Gain} \geq 0.5$
2. $\text{Gain} \leq 3.0$
3. $\text{Gain (max)} / \text{Gain (min)} \leq 2.0$
4. As constant as possible
5. As close to 1.0 as possible



General Sizing Example

NELES

Sizing Example - Installed Flow Characteristics & Gain

- Why is gain important?
 - Sizing a 4" and 6" valve for this same application reveals similar valve results, arguably both of these valves would work fine.
- Relative travel should be between 20% - 80% when possible
 - 6" valve is only open 10% - 30%
 - 4" Valve is open 30% - 75%

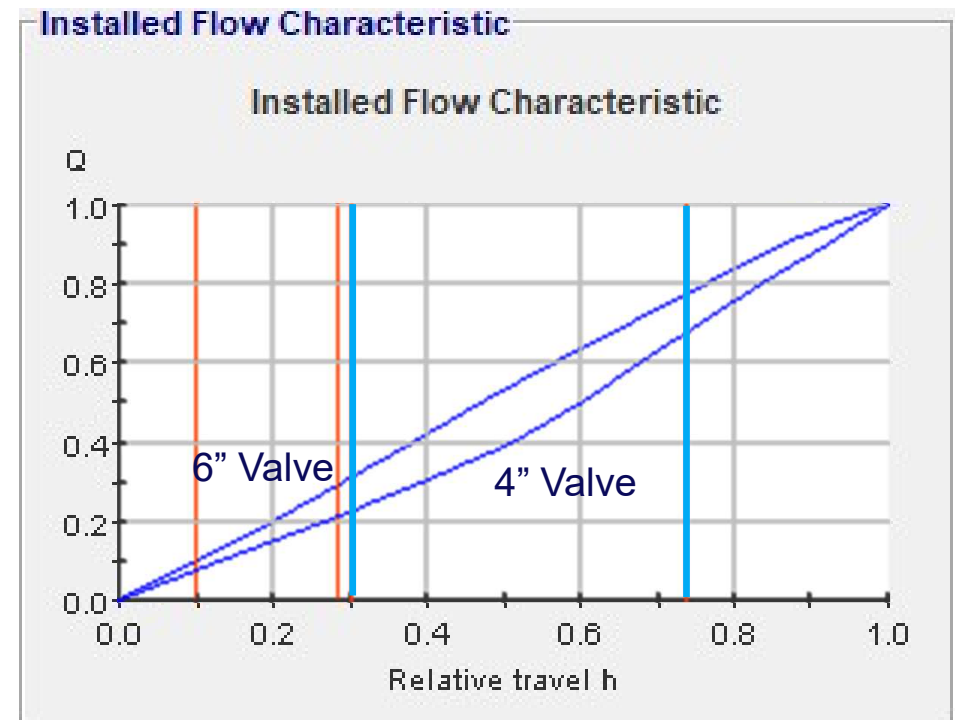
Valve...	Unit	Type	Press rating	Code	Size
	in	ROTARY	ANSI 300	FI-FTO	4
Results	Unit	Case 1	Case 2	Case 3	Case 4
Max capacity	FpCv	225.47			
Req capacity	FpCv	50.8	102	152	167
Travel	%	30.3	55.7	73.7	78.8
Opening	deg	27.3	50.1	66.3	70.9
Noise	dBa [IEC]	58	64	68	69
Flow velocity	ft/s	9.23	18.46	27.68	30.31
Terminal dp	psi	276.18	246.36	227.63	221.8
FI coeff.		0.87	0.83	0.8	0.79

Valve...	Unit	Type	Press rating	Code	Size
	in	ROTARY	ANSI 300	FI-FTO	6
Results	Unit	Case 1	Case 2	Case 3	Case 4
Max capacity	FpCv	520			
Req capacity	FpCv	50.8	102	152	167
Travel	%	10.3	19.7	28.7	31.2
Opening	deg	9.2	17.8	25.8	28.1
Noise	dBa [IEC]	49	56	62	63
Flow velocity	ft/s	4.1	8.2	12.3	13.47
Terminal dp	psi	298.32	281.55	266.2	262.21
FI coeff.		0.9	0.88	0.85	0.85

General Sizing Example

Sizing Example - Installed Flow Characteristics & Gain

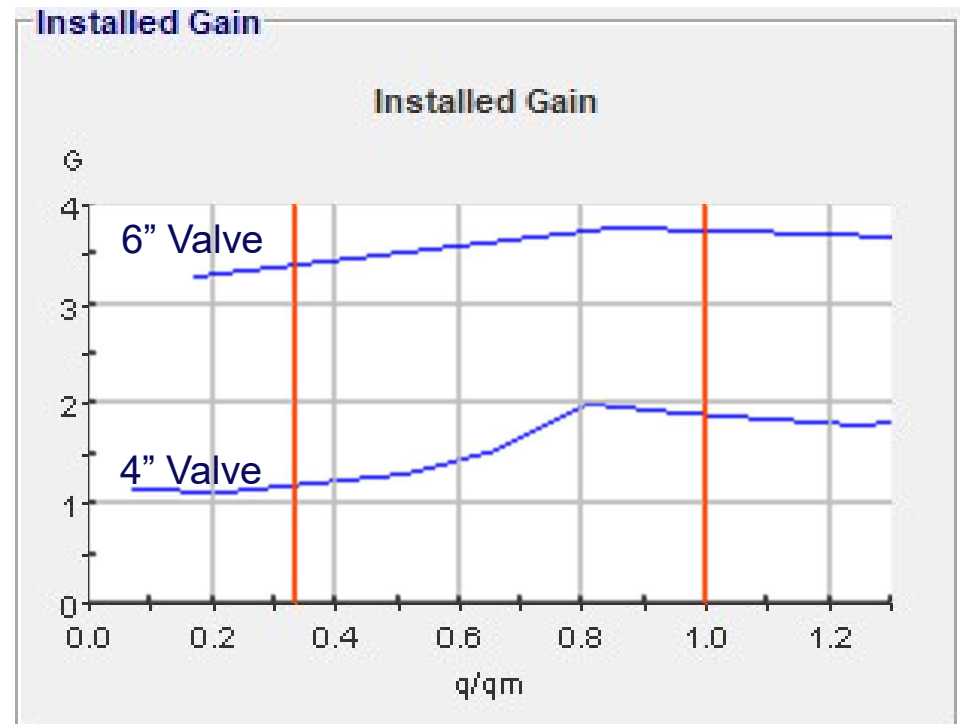
- Reviewing installed flow characteristics alone may sometimes not give you a clear picture.
- The Installed Flow Characteristic line should be as linear as possible
 - Remember the line is drawn for full travel, but it's only between the vertical bars (between min and max flow) that count.



General Sizing Example

Sizing Example - Installed Flow Characteristics & Gain

- Reviewing the gain curve gives us a very clear indicator how the valve will behave.
- A high gain on an equal % or linear valve is a sign the valve may be oversized.
 - Select a smaller valve
 - Select a valve with a lower Cv



General Sizing Example 5

Sizing Example - Installed Flow Characteristics & Gain

- Media: Water
- Valve: 4" RE vs 8" RE
- Class: 300#
- Actuator: Piston
- Fail: Close
- Supply: 60 psi

Pipeline	Unit	Inlet dia	Outlet dia	Thickness	Schedule
	in	8	8		40
Flow data	Unit	Case 1	Case 2	Case 3	Case 4
Liq flow	gpm	100	500	1000	
Inlet temp	degF	60	60	60	
Inlet press	psiG	300	275	250	
Press diff	psi	150	100	50	
Outlet press	psiG	150	175	200	
Vap press	psiA	0.337	0.337	0.337	
DP-shutoff	psi	350			

General Sizing Example 5

Sizing Example - Installed Flow Characteristics & Gain

NELES

Nelprof 6.2.12

File Edit Create Calculation ISA Sheet Sort Preferences Help

Toggle Width Expand/Collapse

☐ Nelprof Control Valve Training

- ☐ Area
 - ☒ Overview
 - ☐ Example 1 - Basic Sizing
 - ☐ Example 2 - Noise
 - ☐ Example 3 - Velocity
 - ☐ Example 4 - Gain
 - ☒ Example 5 - Gain
 - ☐ R-series 4"
 - ☐ R-series 8"
 - ☐ Example 6 - FpCv

Control Notes and warnings Characteristics Curves Comparison

Media Selection

☒ Liquid ☐ Water ☐ Pulp

☐ Gas ☐ Steam ☐ 2-phase

Design Parameters

Crit press psia 3208.214
Special servi Normal
Dpm-factor 0.3

Design P psia
DesignTmax degF
DesignTmin degF

☒ Actuator sizing
☐ Recommended safety factor

☐ Resistors **Details**

Calculate

Result:
Valve **RE, 4 in**
Actuator **B1J8**

☐ Expand all

Pipeline

Unit	Inlet dia	Outlet dia	Thickness	Schedule
in	8	8		40

Flow data

Unit	Case 1	Case 2	Case 3	Case 4
Liq flow	gpm 100	500	1000	
Inlet temp	degF 60	60	60	
Inlet press	psiG 200	180	160	
Press diff	psi 150	100	50	
Outlet press	psiG 50	80	110	
Vap press	psia 0.337	0.337	0.337	
DP-shutoff	psi 350			

Valve...

Unit	Type	Press rating	Code	Size
in	SEGMENT	ANSI 300	RE	4

Results

Unit	Case 1	Case 2	Case 3	Case 4
Max capacity	FpCv 390.91			
Req capacity	Cv 8.17	50.3	147	
Travel	% 10.5	35.1	61.3	
Opening	deg 17.3	38.6	61.4	
Noise	dBA [IEC] 74	82	70	
Flow velocity	ft/s 2.64	13.18	26.35	
Terminal dp	psi 189.41	162.22	120.46	
FI coeff.	0.94	0.91	0.83	

Construction

Material	Seat	Gland pack	Bearings	Safety factor
Metal, Type S	PTFE/TFE	PTFE	PTFE	1.2

Actuator...

Code	Size	Unit	Supply press	Spring rate
B1J	AUTOM	psiG	60	

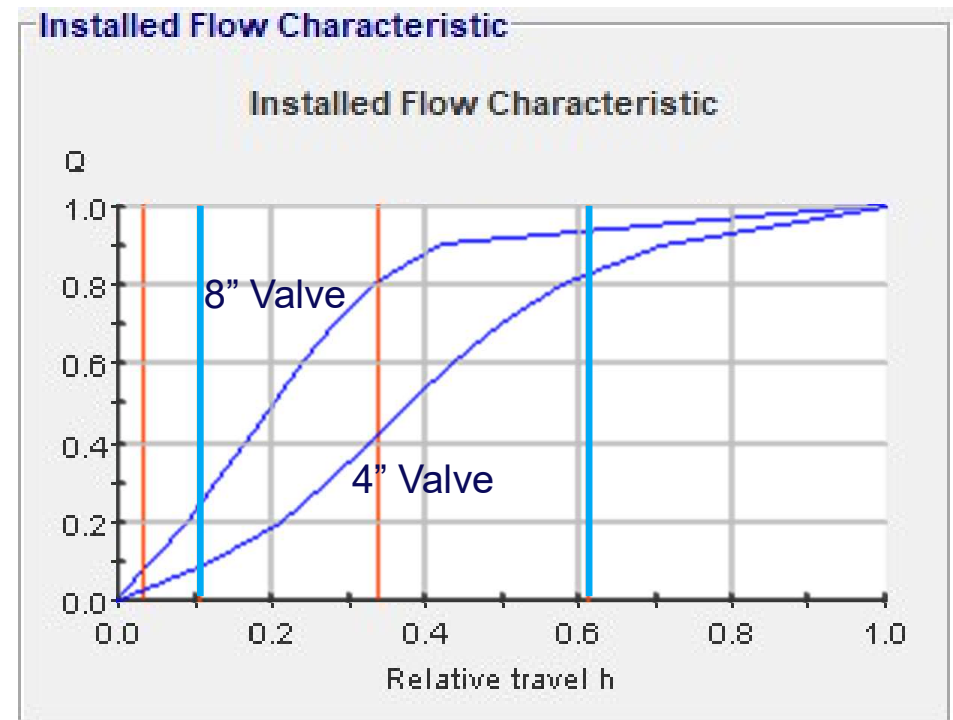
Torques

	ftlb	To close	ftlb		
To open	40				32
Opening LF	% 42	Closing LF	%		57
Control open	ftlb 24		22		21
Ctrl open LF	% 30		31		30
Control close	ftlb 21		20		18
Control close LF	% 40		35		26

General Sizing Example

Sizing Example - Installed Flow Characteristics & Gain

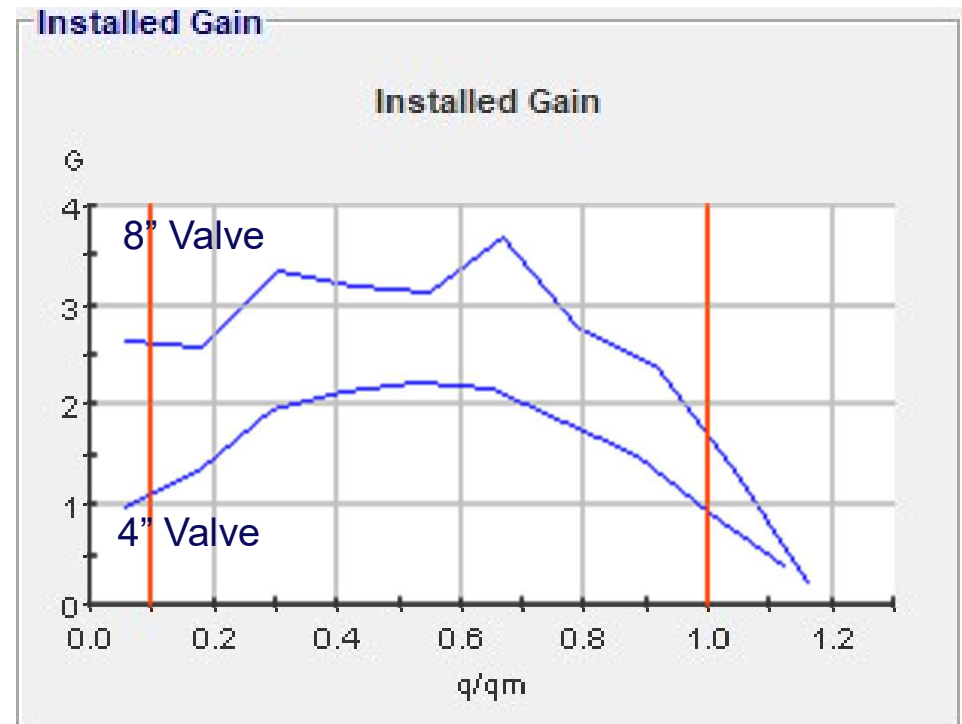
- The Installed Flow Characteristic line should be as linear as possible
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General Sizing Example

Sizing Example - Installed Flow Characteristics & Gain

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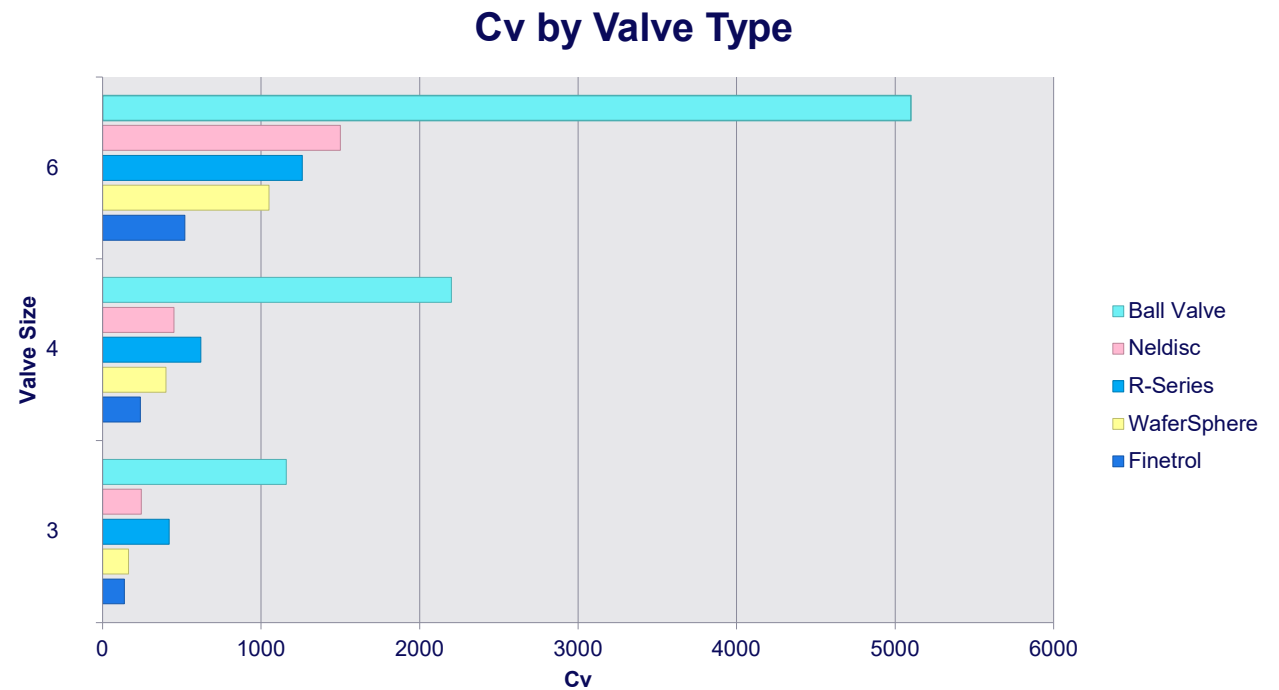
C_v – Valve Capacity

General Sizing Example

Valve Capacity

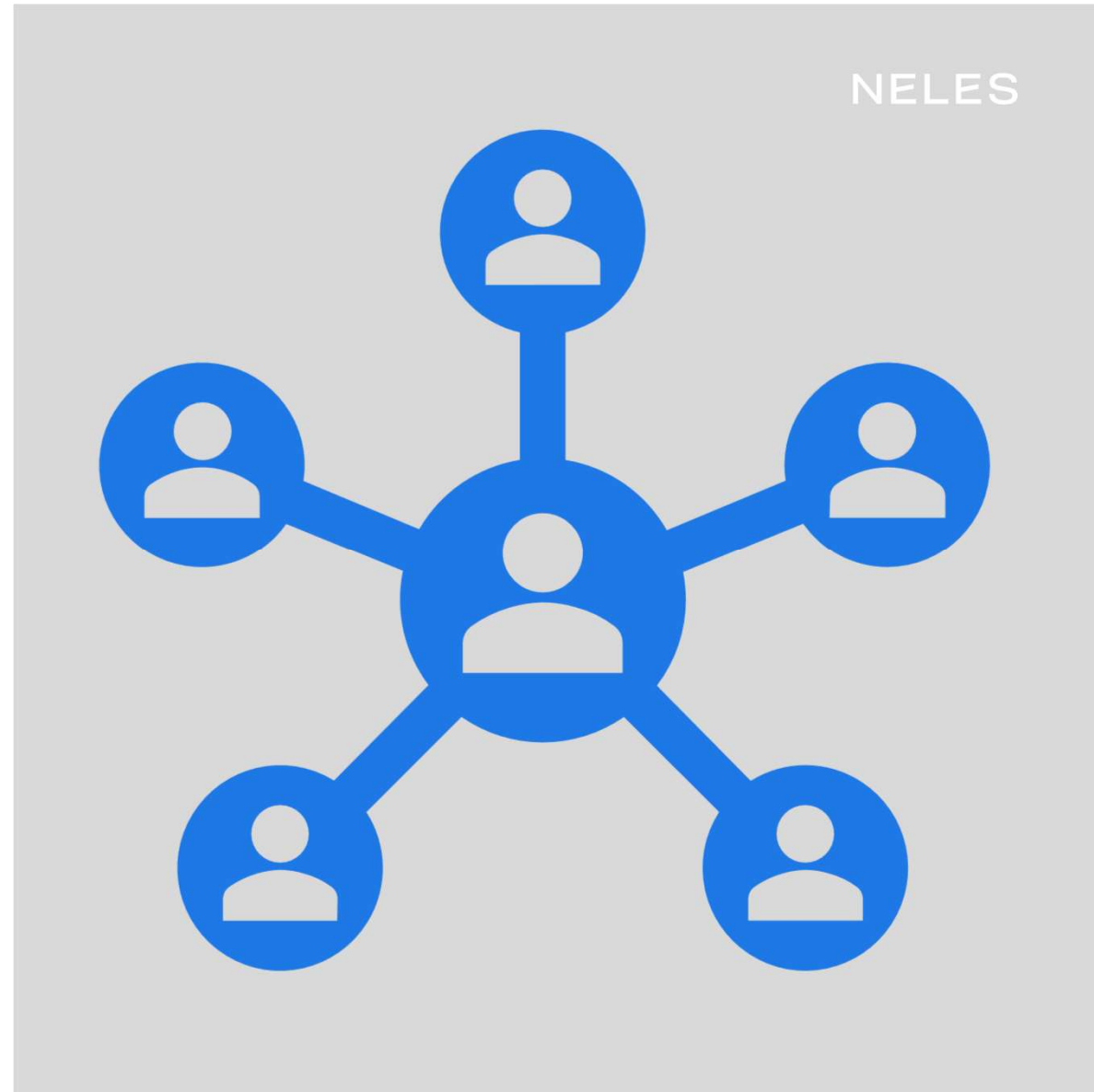
- Higher capacity is required with lower dP applications

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Contact us

- Steven Hocurscak
 - Steven.Hocurscak@neles.com
- Applications Engineering
 - apps.engineering@neles.com
- Area Sales Managers map
 - Link to [map](#)



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