MACS 2017

A/C Valve Application & Service

Jeffrey A. Schultz, P.E.
Product Engineering Manager

TOPICS

- 1. Selection of valves for mobile AC Systems
- 2. Servicing AC Valves in mobile AC Systems

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Selection of valves for MAC Systems

Valve Applications

Three AC Valve Applications

SYSTEM APPLICATION	LOW PERMEATION	HIGH FLOW *	ROBUSTNESS	LOCATION
Factory Fill	X	X	X	HS, LS, Both
Service Fill	X		X	LS
Switch Ports	X			HS & LS Switch

* Depends on Assembly Plant Process

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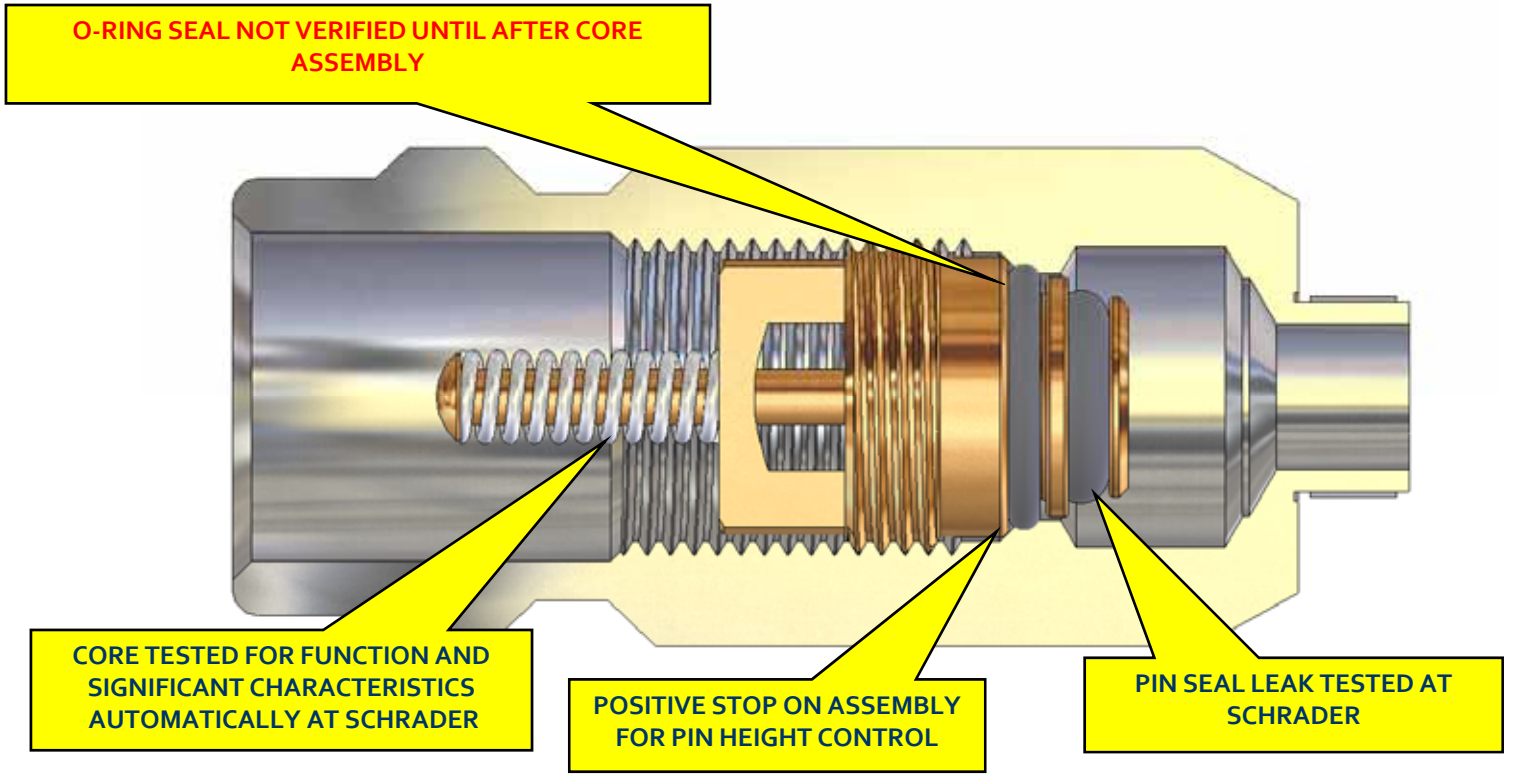
Selection of Charge / Access Valve

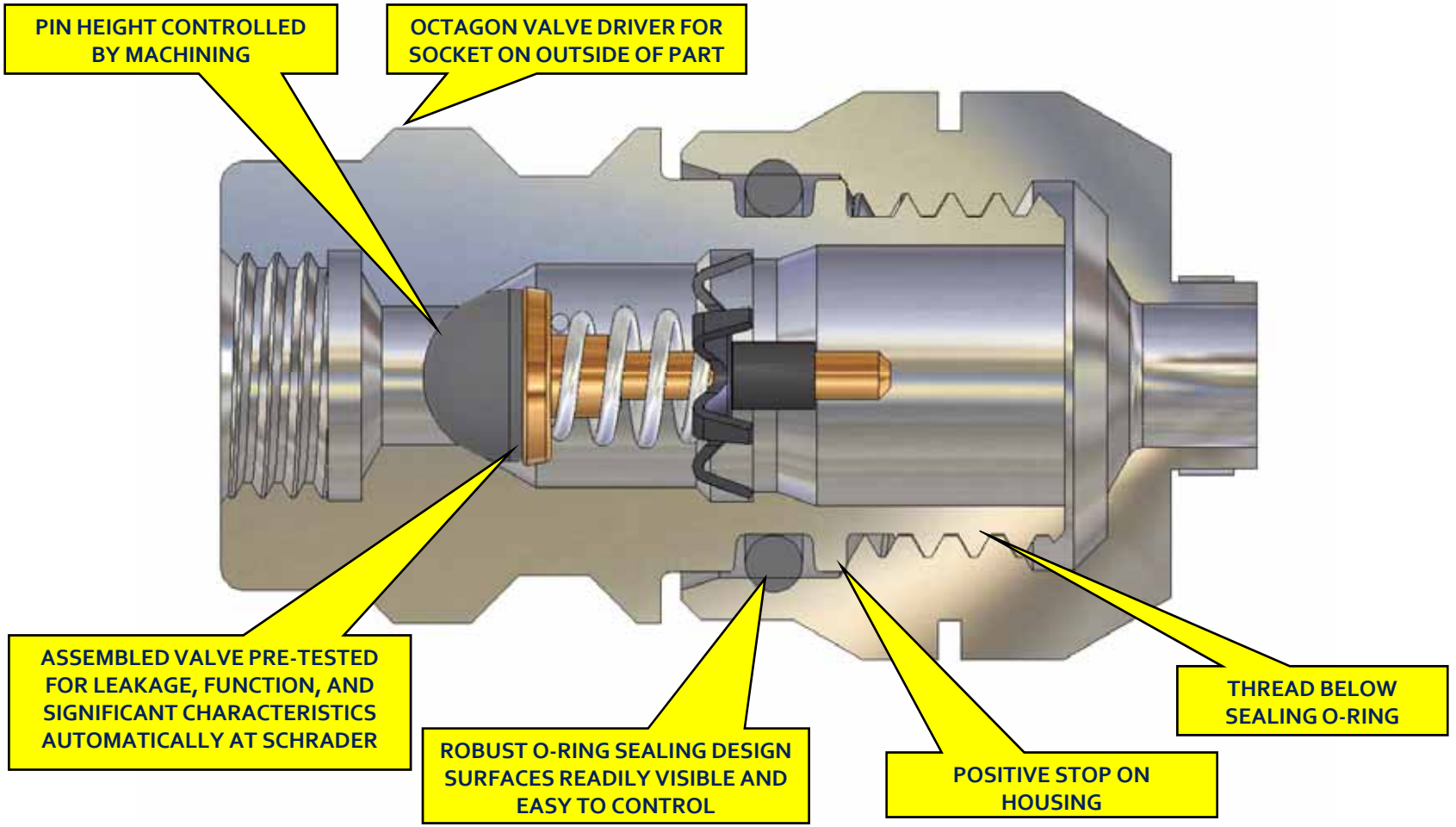
High Flow Cores

- Factory Fill Process

M10 Core


O-RING SEAL NOT VERIFIED UNTIL AFTER CORE ASSEMBLY
CORE TESTED FOR FUNCTION AND SIGNIFICANT CHARACTERISTICS AUTOMATICALLY AT SCHRADER
POSITIVE STOP ON ASSEMBLY FOR PIN HEIGHT CONTROL
PIN SEAL LEAK TESTED AT SCHRADER

"Primary Seal" (Integrated Valve)

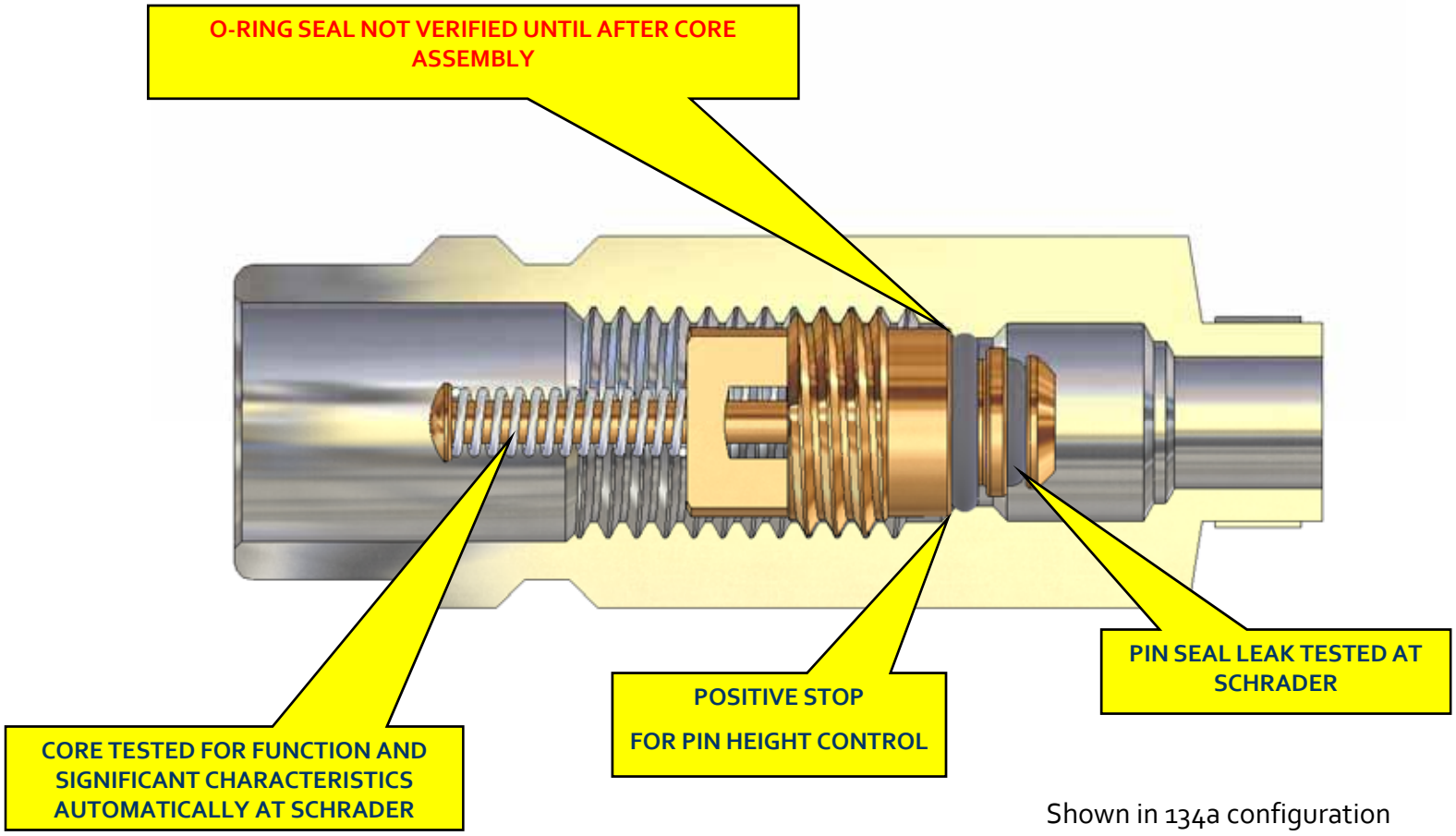


Shown in 134a configuration

Selection of Charge / Access Valve

Medium & Low Flow Cores
- System Access and Service

M8 (North America) Core



Shown in 134a configuration

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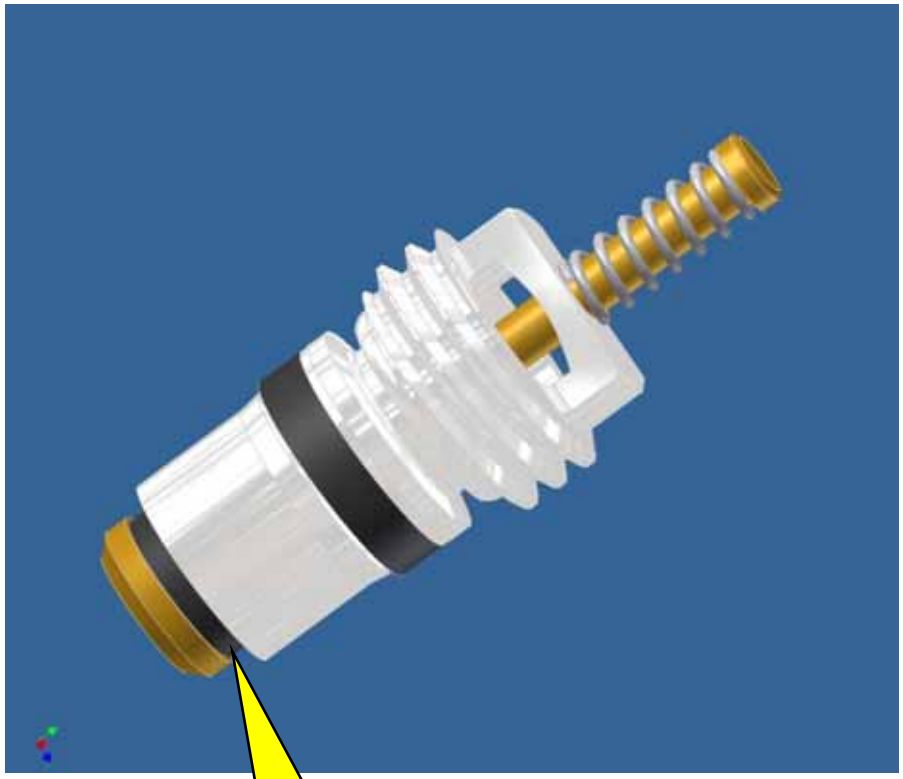
Valve Technology
M8 Core (Europe)



CORE TESTED FOR FUNCTION AND SIGNIFICANT CHARACTERISTICS AUTOMATICALLY AT SCHRADER

Robust Taper Plug Seal

Leak Tested at SCHRADER

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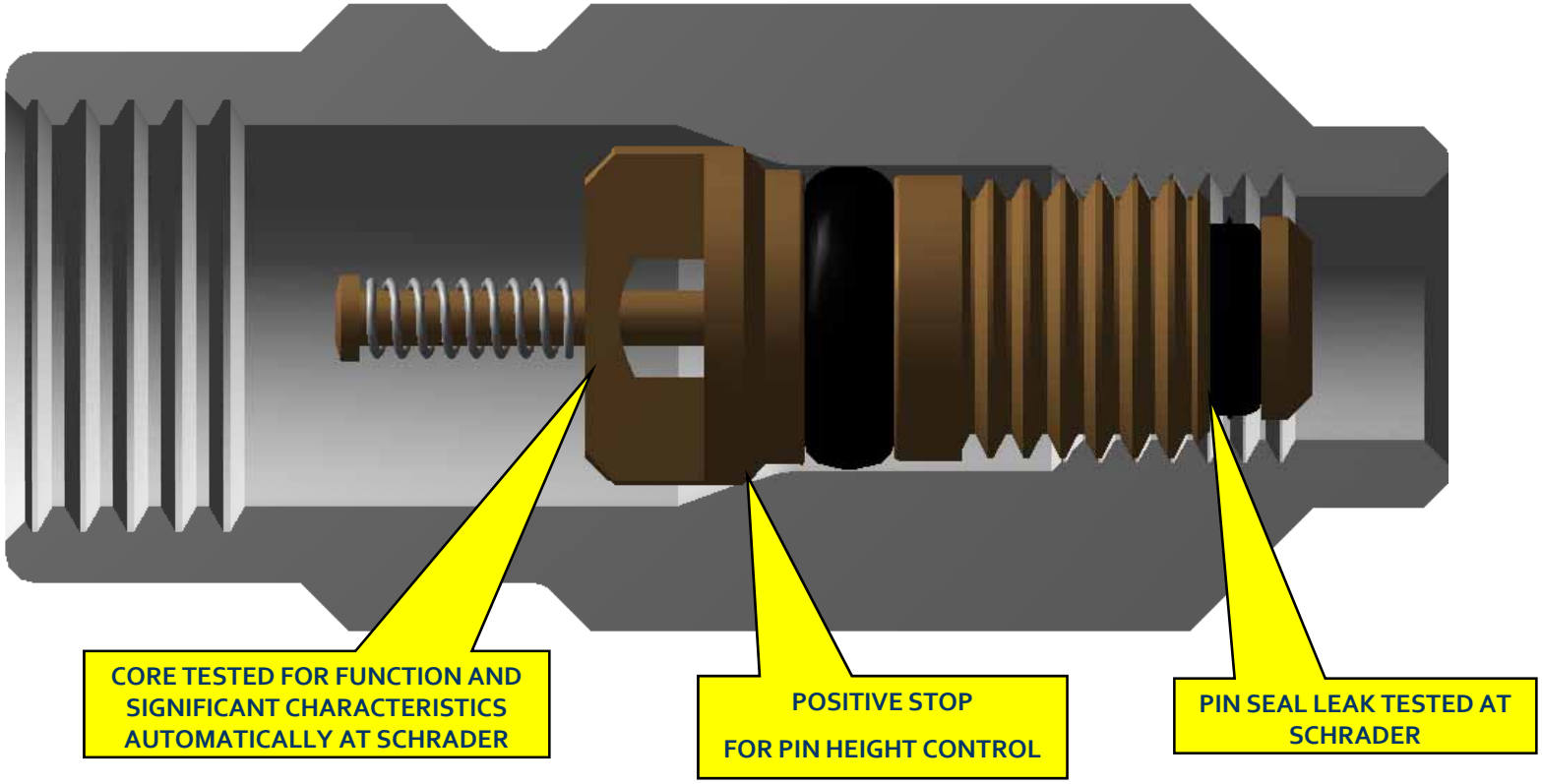
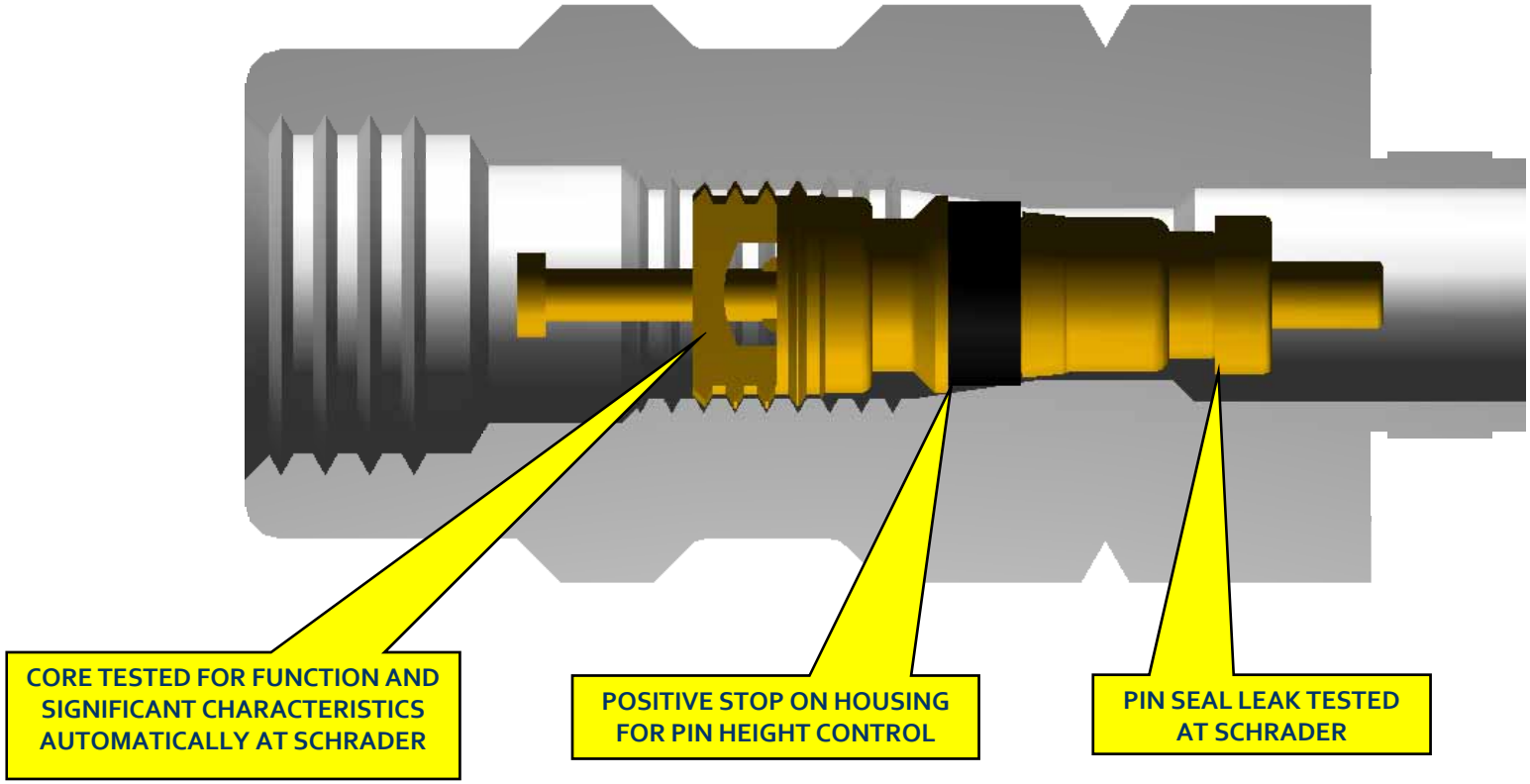
JRA Core



Shown in 134a configuration

Standard Core (North America)



Shown in 134a configuration

Charge / Access Valve Materials

OE preference for Seal Materials

Valve Technology

Seal Material Availability

Valve		Neoprene	HNBR	EPDM
Primary Seal		X	X	X
10mm Core		X	X	X
8mm Core		X	X	X
JRA Core			X	
Standard Core		X	X	

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Valve Technology

SEAL SELECTION

1. **POLYMER – Chemical resistance to refrigerant oils (Worst to Best)**
   a. Neoprene – PAG & PVE systems only
   b. HNBR – All Systems
   c. EPDM – PAG & PVE systems only
   d. FKM…..GFL…..GFLT – Not Suitable for AC Service
2. **COMPOUND MODIFIERS – for durability**
3. **HARDNESS – seal-ability v durability**
   a. 70 durometer – higher seal consistency
   b. 80 durometer – higher strength & durability

Valve Technology

SEAL SELECTION

Permeation rate: Refrigerant loss (Best to Worst)

1. Neoprene
2. HNBR
3. EDPM

Valve Technology

Relative Application Guidelines

		Integrity		Flow
Valve		Permeation	Robustness	Evacuation
Primary Seal		+	+++	+++
10mm Core		B	++	+++
8mm Core		++	++	++
JRA Core		++	+	+
Standard Core		++	B	B

B is Baseline

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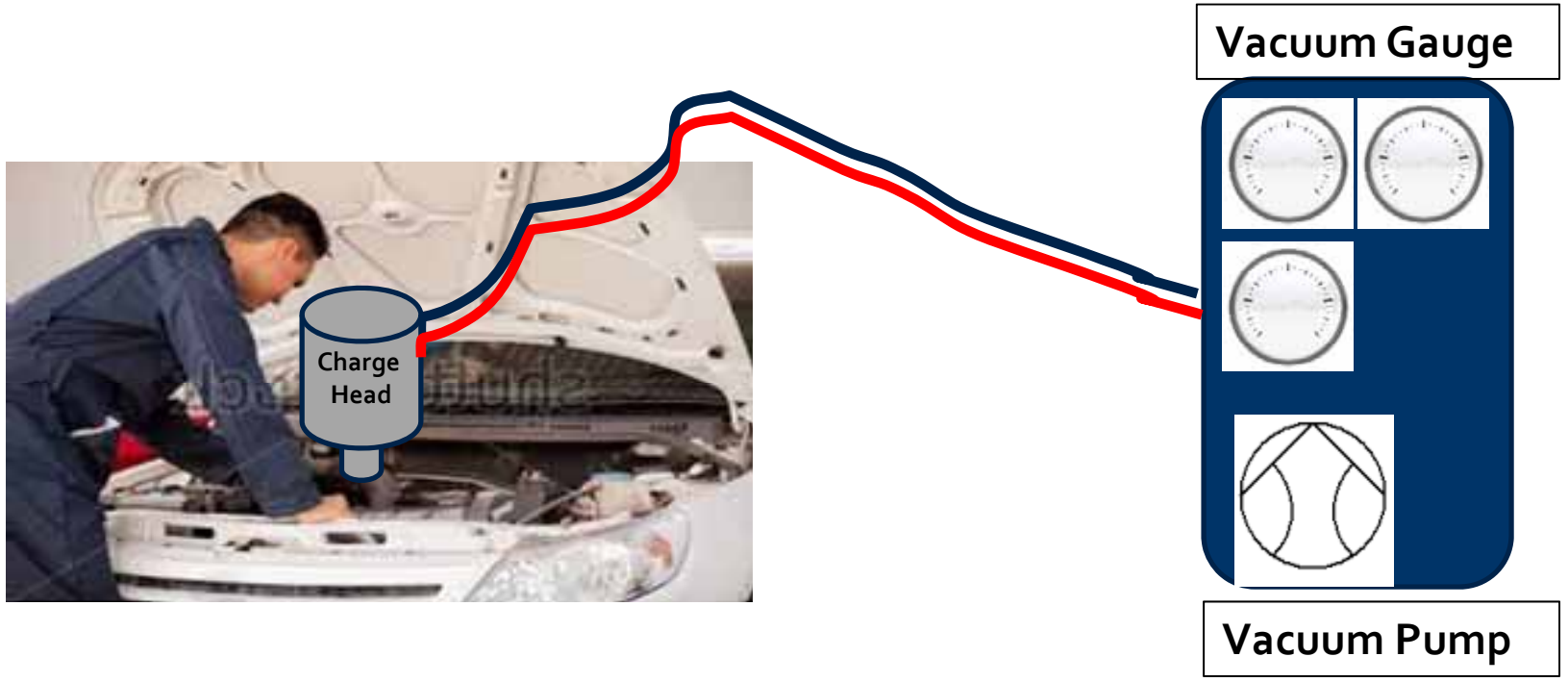
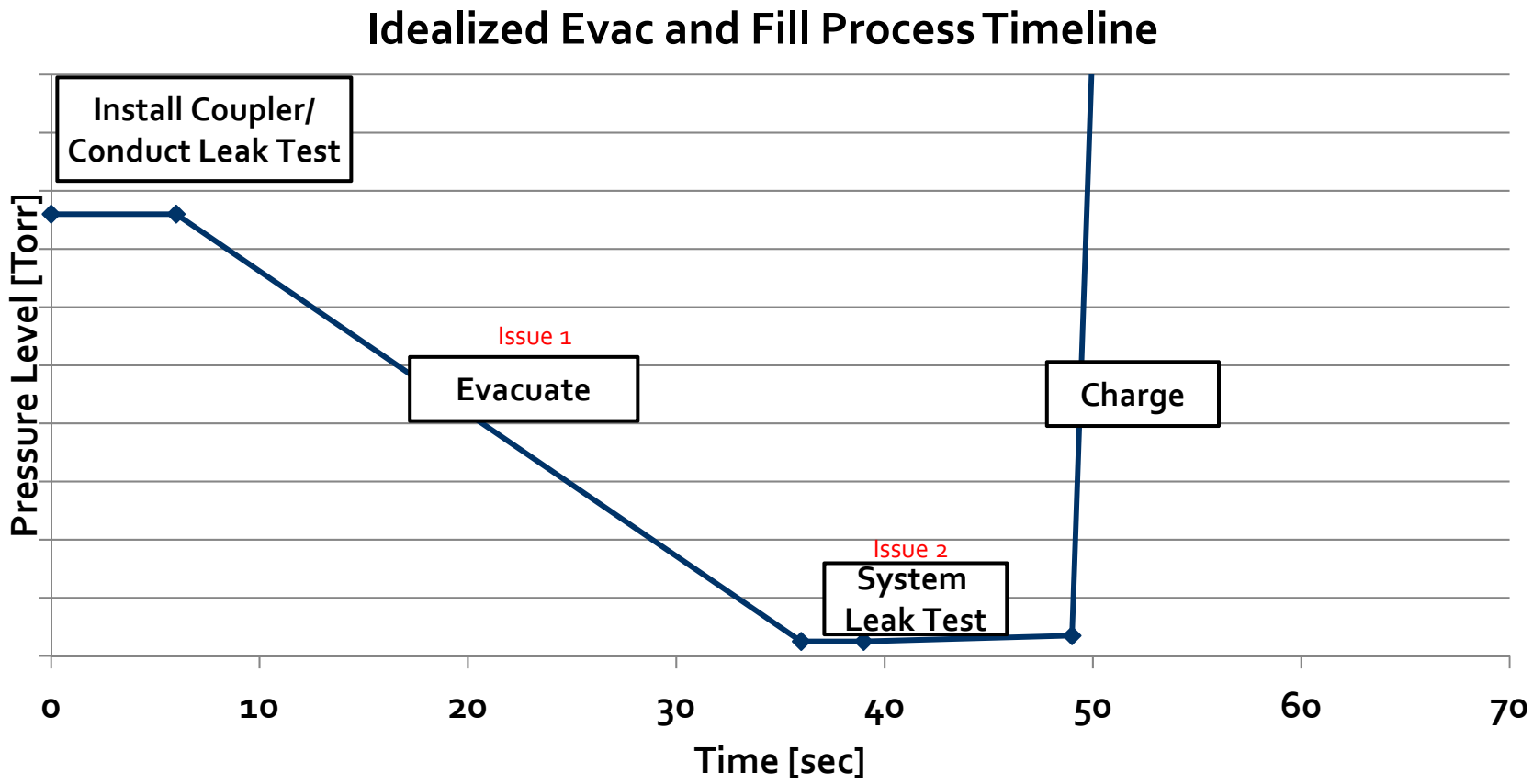
High Flow Valves – Factory Fill

1. Remove moisture
2. Conduct leak test

Schematic of Charging Process



Evac and Fill Process



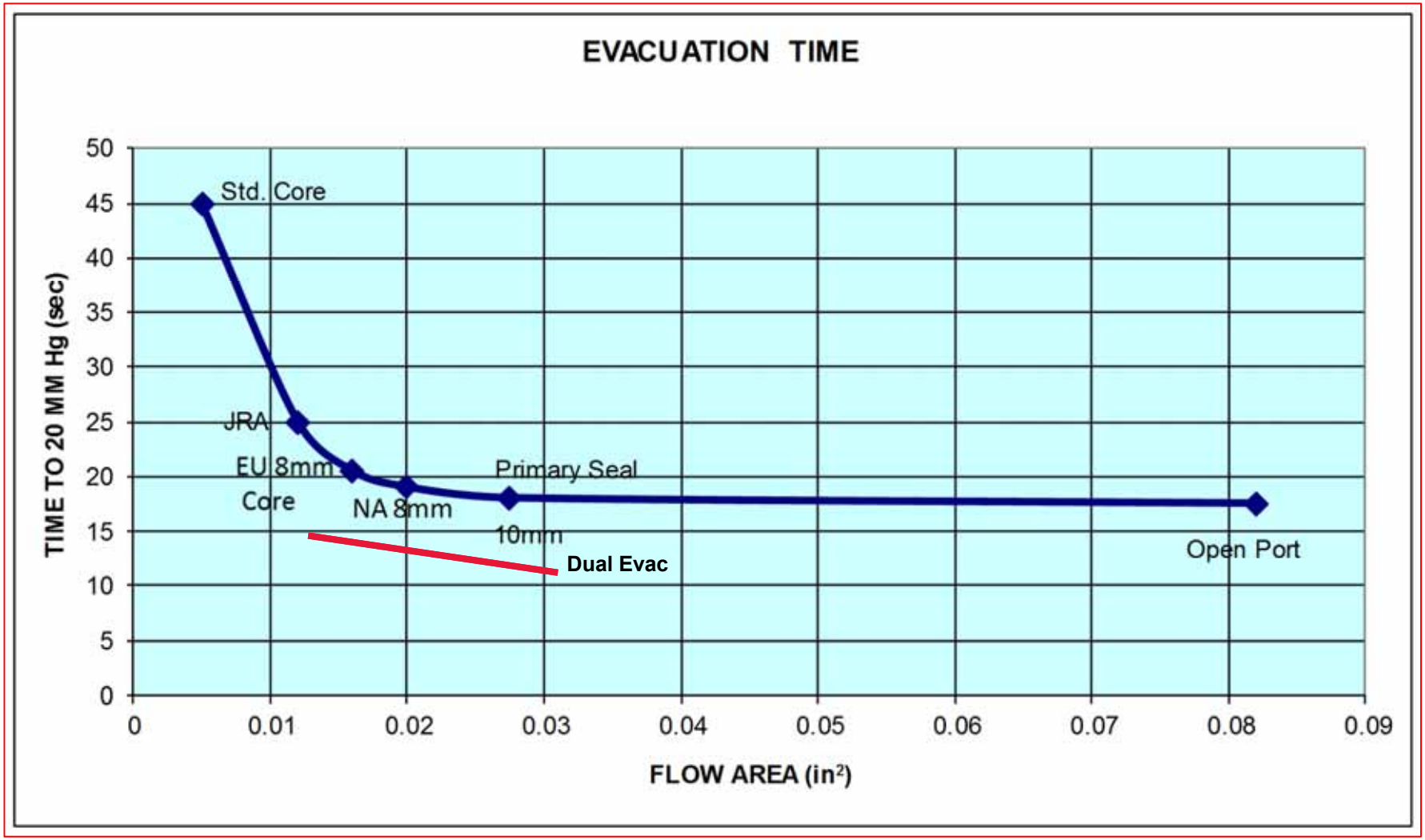
Factory Evacuation and Fill Process

Issue 1. Remove air and water from the system in the minimum process time:

Large bore charge valves (or dual evacuation!) are critical to achieving optimum evacuation prior to charging

Evacuation Time

134a Charge System



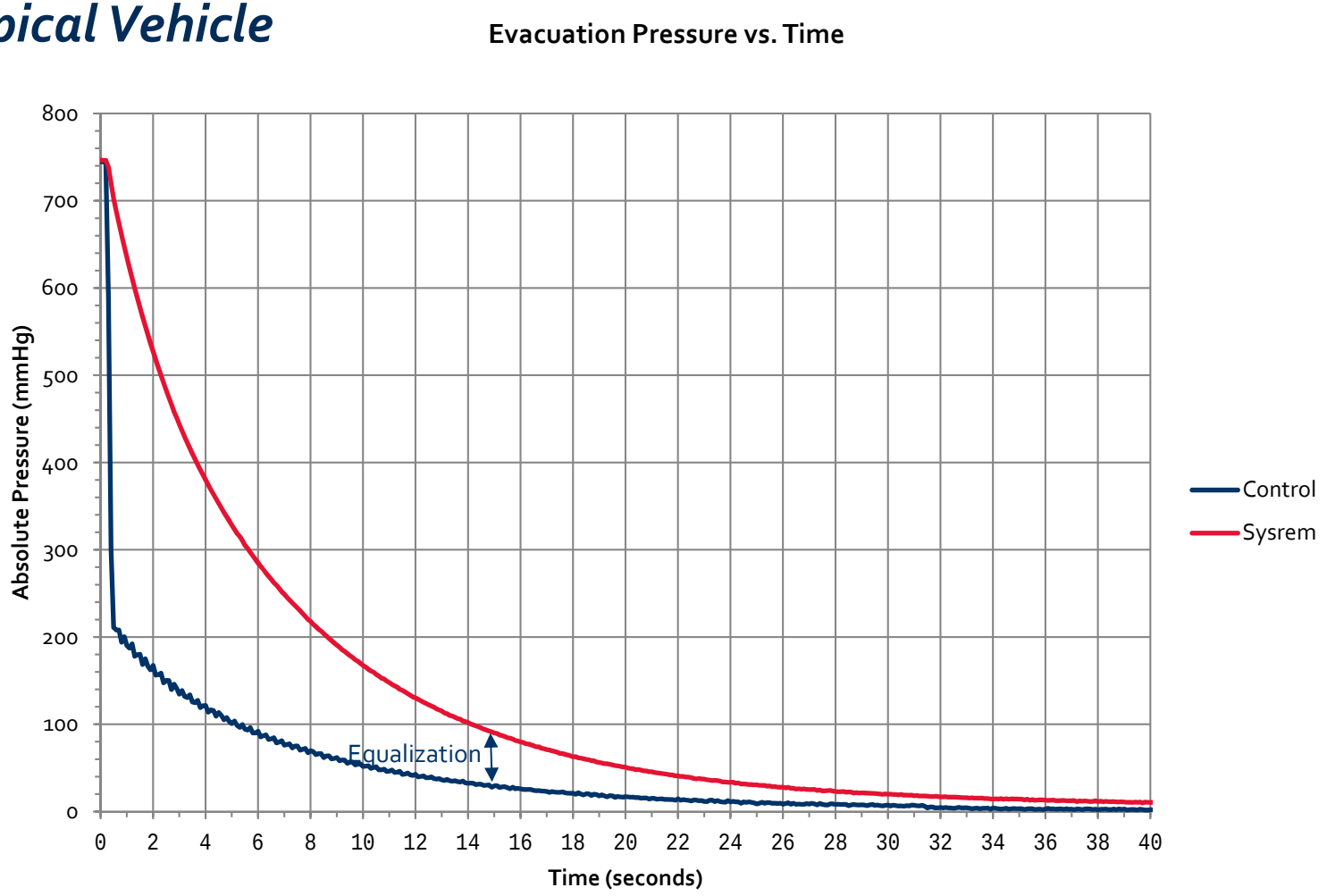
Factory Evacuation and Fill Process

Issue 2. Leak check prior to charging:

a. The leak check currently performed after evacuation is inadequate to find leaks smaller that 75 lbs/yr of refrigerant.

b. High flow valves minimize evacuation time allowing increased time for leak testing.

Evacuation Time – Typical Vehicle



Valve Technology

Evacuation Capability, Pressure after 30 seconds:

Valve	System Pressure (mm Hg)	Cabinet Pressure (mm Hg)	Pressure Rise Equalization (mmHg)
Standard Core	77	14	63
JRA Core	42	10	32
8mm Core	35	6	29
10mm Core	22	5	17
Integrated Valve	20	7	13

Demonstration Stand Data

Servicing AC Valves

Simplify the choices in servicing charge valves

1975 Cadillac Eldorado Biarritz

Charge and Service Valves

For OE customers, there are 16 options from us alone, depending on:

1. Refrigerant
2. Refrigerant oil
3. Assembly plant charging system
4. Sealing system rubber compound preference

For Service marketplace, we simplify to 6 options:

1. Schrader family of Universal Valves
2. 6 Cores, one of each style
3. OE Quality, made in USA

Valve Service

IMPORTANT STEPS

1. Assess valve Condition
   a) When
   b) How
2. Replacing Valves
   a) When
   b) How
3. Other Service Issues
   1. Replacing / Refilling Refrigerant & Oil
   2. Converting Refrigerant

Valve Service

ASSESSING VALVE CONDITION

a) When: Test valve leakage before recharging

b) How:

c) 1. Look for dye

d) 2. Look for oil

e) 3. Use halogen leak detector

   a) Use proper instrument sensitivity

   b) Flush top of valve of accumulated refrigerant

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Valve Service

REPLACING VALVES

When: When valve leakage is found

How:

1. Never re-use a valve that has been removed
2. Clean the port before removing valve
3. Use proper drive tool
    a) Octagon socket for integrated valve
    b) "Right-sized" core driver
4. Clean the open port of thread debris

Valve Service

REPLACING VALVES

5. Use Schrader Universal Valve or OE Part
6. Lubricate external o-rings with refrigerant oil
7. Torque the valve correctly
8. Confirm core pin height after assembly
9. Reinstall the cap

Valve Service

RECOMMENDED VALVE TORQUE

Std. Core: 0.36 – 0.67 Nm / 3 – 6 in-lbs
JRA: 0.56 – 1.13 Nm / 5 – 10 in-lbs
8mm: 1.13 – 2.26 Nm / 10 – 20 in-lbs
10mm: 1.70 – 3.40 Nm / 15 – 30 in-lbs
Primary Seal (HS): 9.5 – 13.6 Nm / 7 – 10 ft-lbs
Primary Seal (LS): 6.8 – 9.5 Nm / 5 – 7 ft-lbs

Valve Service

REPLACING / REFILLING REFRIGERANT or REFRIGERANT OIL

1. Refrigerant
   a) Use same refrigerant as new
   b) Use only known sources of quality refrigerant
   c) May not back convert R-1234yf to R-134a
2. Refrigerant Oil
   a) PAG - Use oil recommended by OEM
   b) POE – ABSOLUTELY use same oil recommended by OEM
   c) PAG & POE - Do not use an R134a oil in a R1234yf system.
      i.

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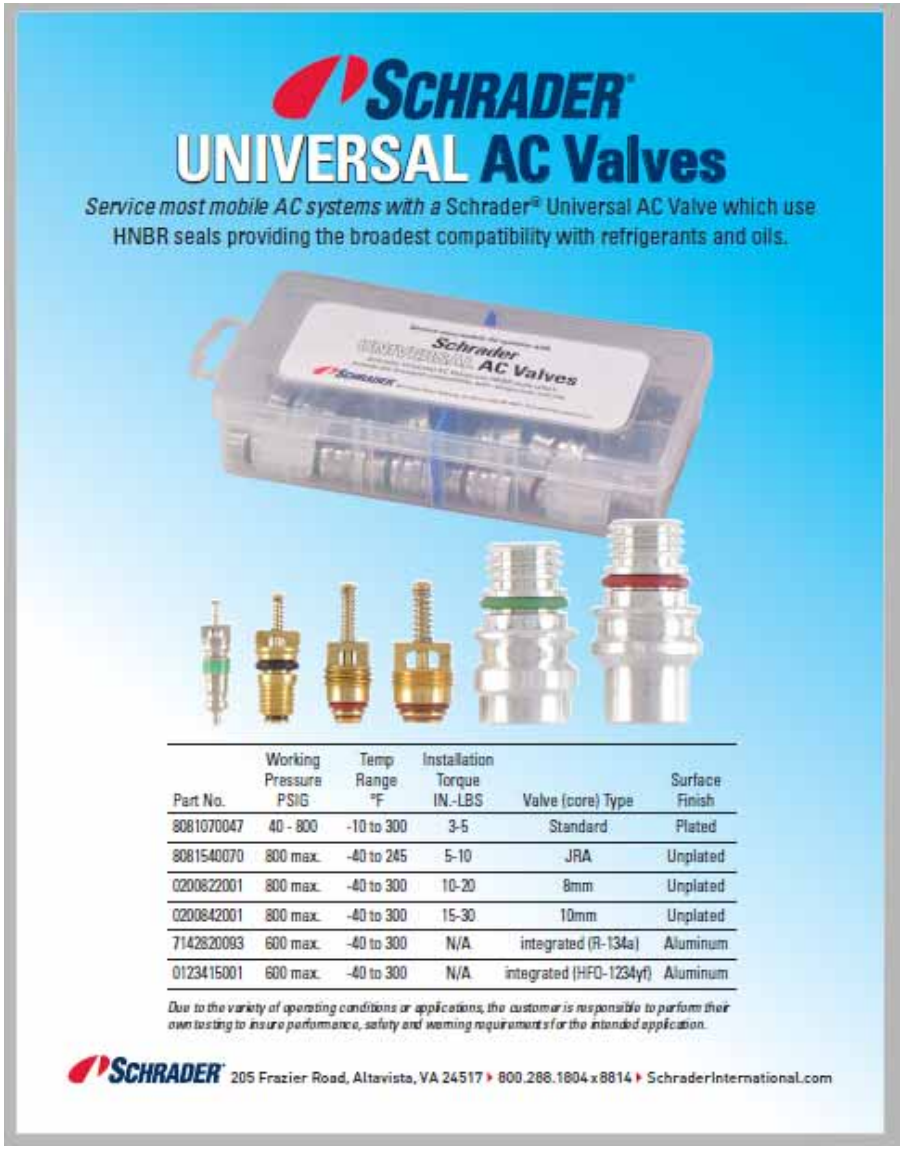
Valve Service

i.



Part No.	Working Pressure PSIG	Temp Range °F	Installation Torque IN.-LBS	Valve (core) Type	Surface Finish
8081070047	40 - 800	-10 to 300	3-5	Standard	Plated
8081540070	800 max.	-40 to 245	5-10	JRA	Unplated
0200822001	800 max.	-40 to 300	10-20	8mm	Unplated
0200842001	800 max.	-40 to 300	15-30	10mm	Unplated
7142820093	600 max.	-40 to 300	N/A	integrated (R-134a)	Aluminum
0123415001	600 max.	-40 to 300	N/A	integrated (HFO-1234yf)	Aluminum

Due to the variety of operating conditions or applications, the customer is responsible to perform their own testing to insure performance, safety and warning requirements for the intended application.

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Importance of Quality

Experiment by Toyota
SAE J2843 development

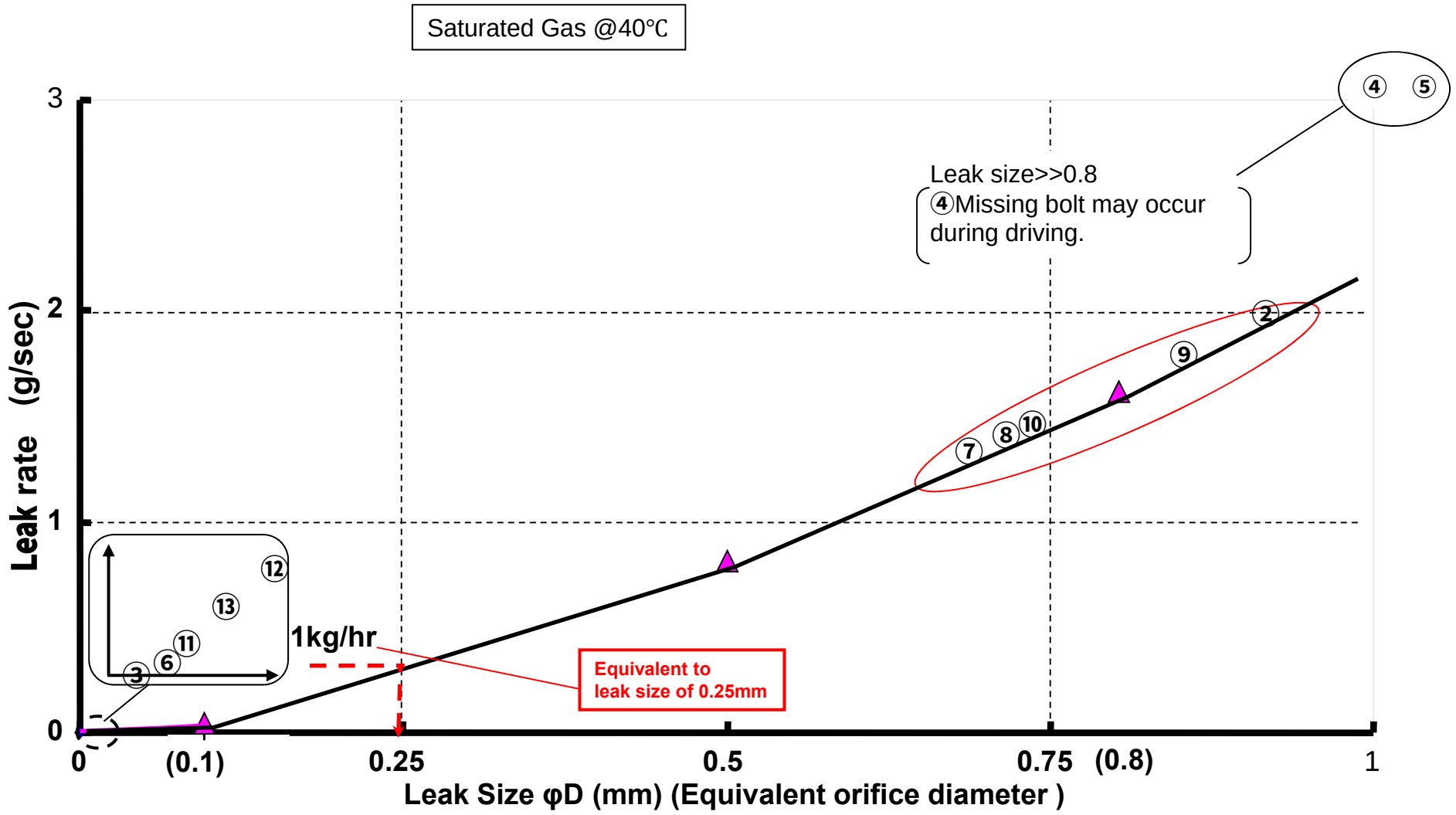
Small Leak Defects

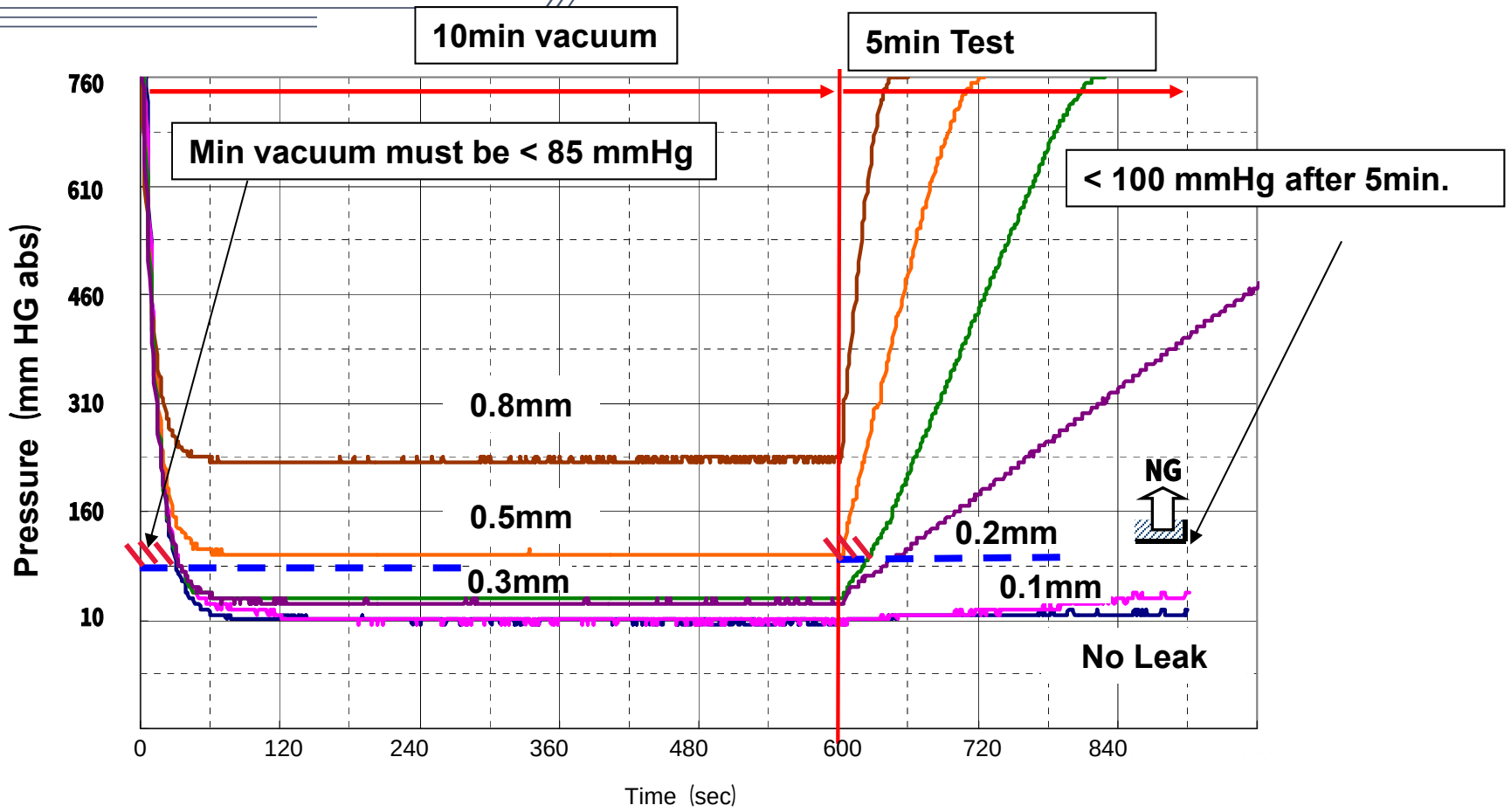
①No Defect
③No oil on O-ring
⑥wrong size O-ring
⑪Evap block damage (screwdriver)
⑫Dust contaminant from working gloves(180μm)
⑬A hair (70μm)

Large Leak Defects

②No O-ring
④Forgotten fasten bolts
⑤Missing fasten bolt torque
⑦Scratch O-ring surface D cut
⑧Scratch O-ring surface) V cut
⑨Cut/Torn O-ring
⑩Pinch O-ring

Reference Leak Paths


Saturated Gas @40℃
Leak size>>0.8
④Missing bolt may occur during driving.
④ ⑤
Leak rate (g/sec)
3
2
1
0
0
(0.1)
0.25
0.5
0.75
(0.8)
1
Leak Size φD (mm) (Equivalent orifice diameter)
1kg/hr
Equivalent to leak size of 0.25mm
② ⑨ ⑦ ⑧ ⑩
⑫ ⑬ ⑪ ⑥ ③



Slide from Toyota Presentation on SAE J2843 development

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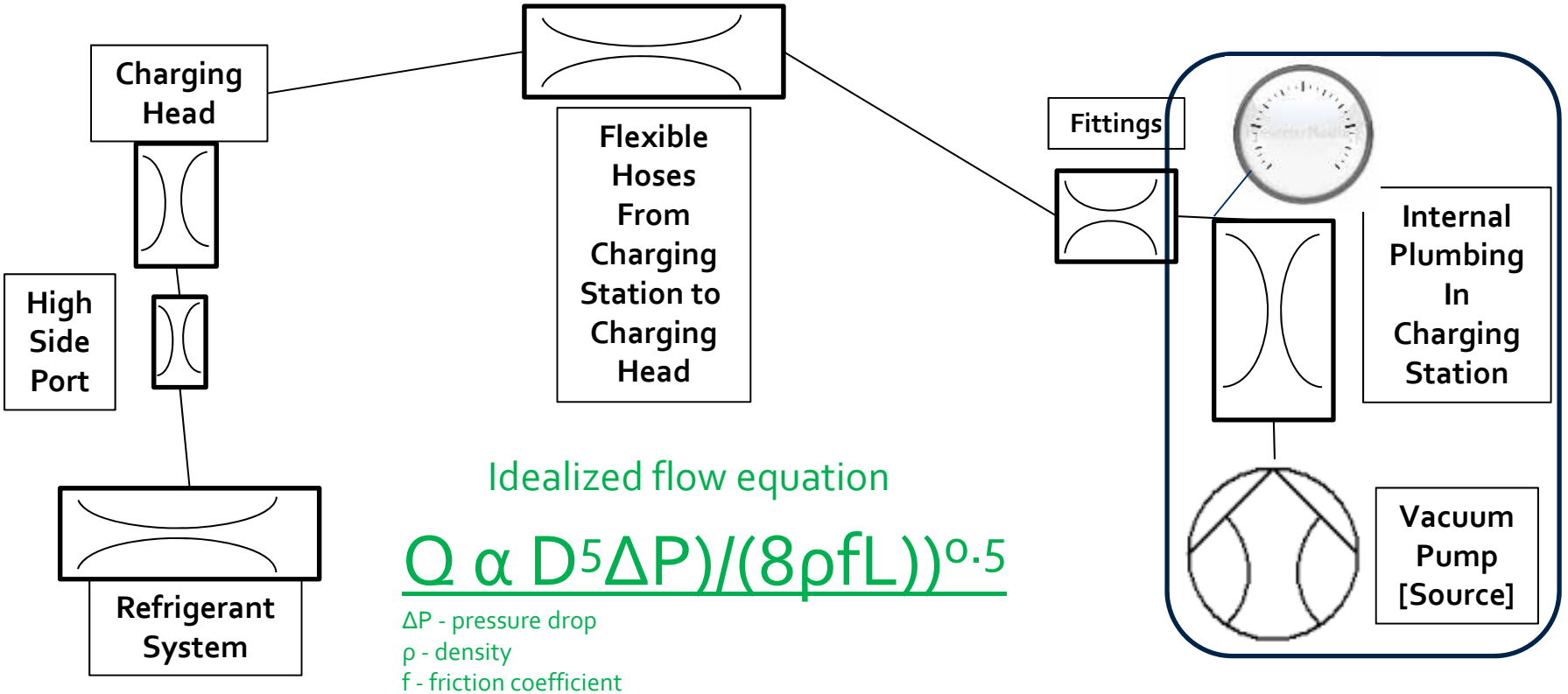
QUESTIONS ?

Schematic of Factory System

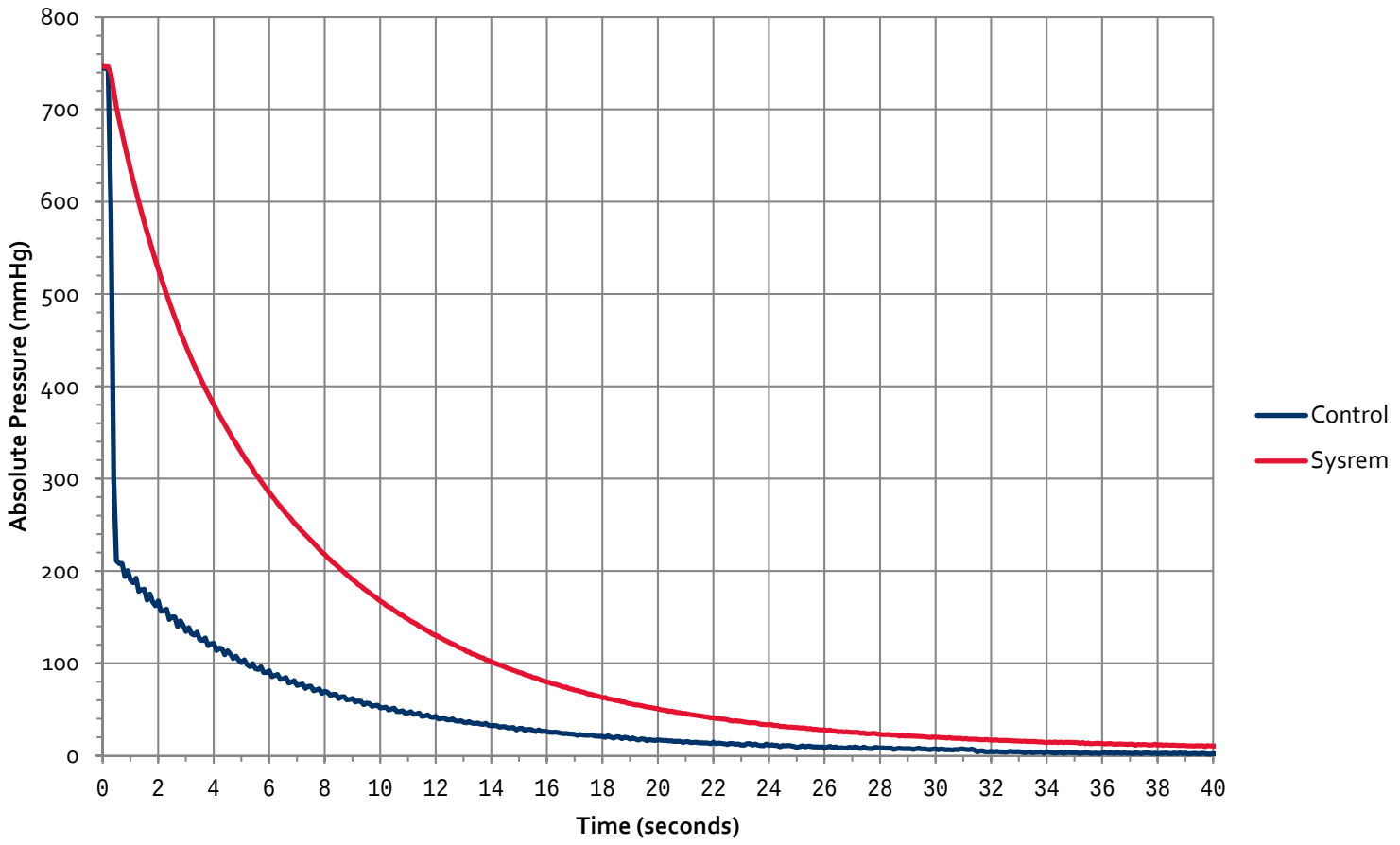


Idealized flow equation

$$Q \alpha D^5 \Delta P)/(8 \rho f L))^{0.5}$$

ΔP - pressure drop
ρ - density
f - friction coefficient
L - pipe length
D – minimum internal pipe diameter
Q - volumetric flow rate

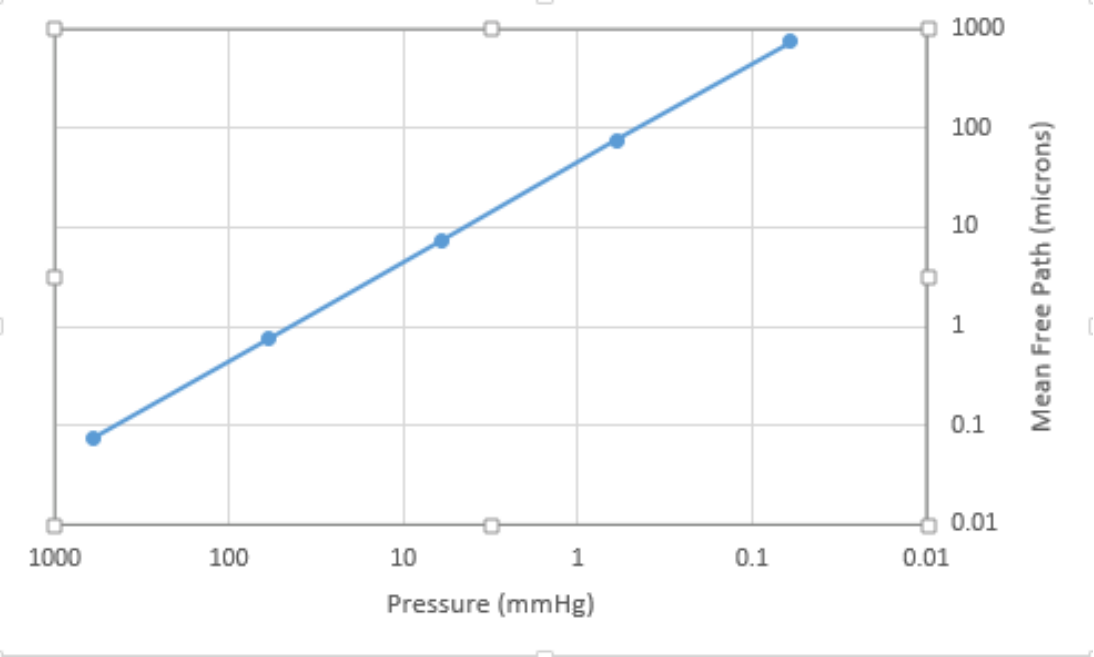
Evacuation Time – Typical Vehicle



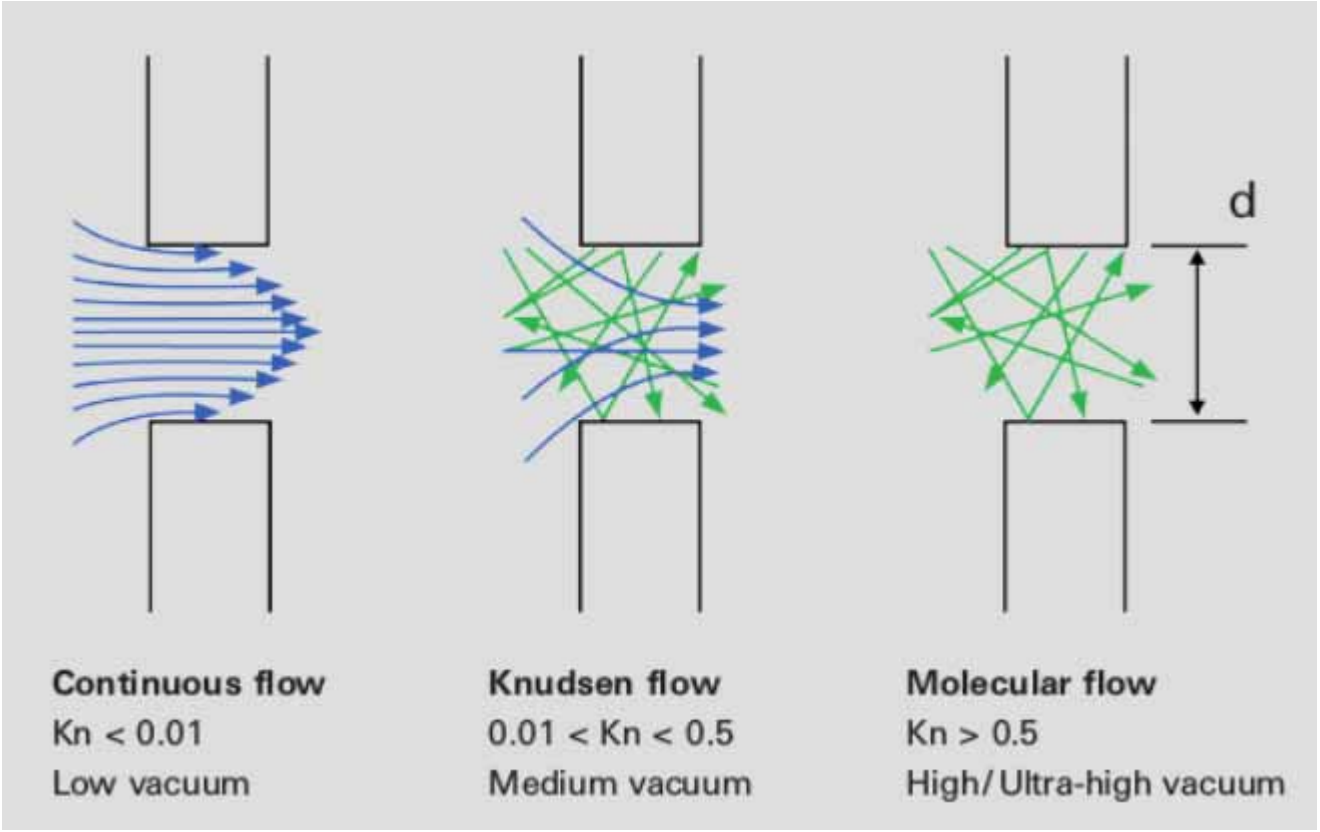
Evacuation Rate is a Function of Pressure

- Flow in vacuum (evacuation) depends on communication between gaseous molecules
  - Communication between molecules is a function of the "Mean Free Path" between molecules
  - Mean Free Path is a function of pressure and flow path width:

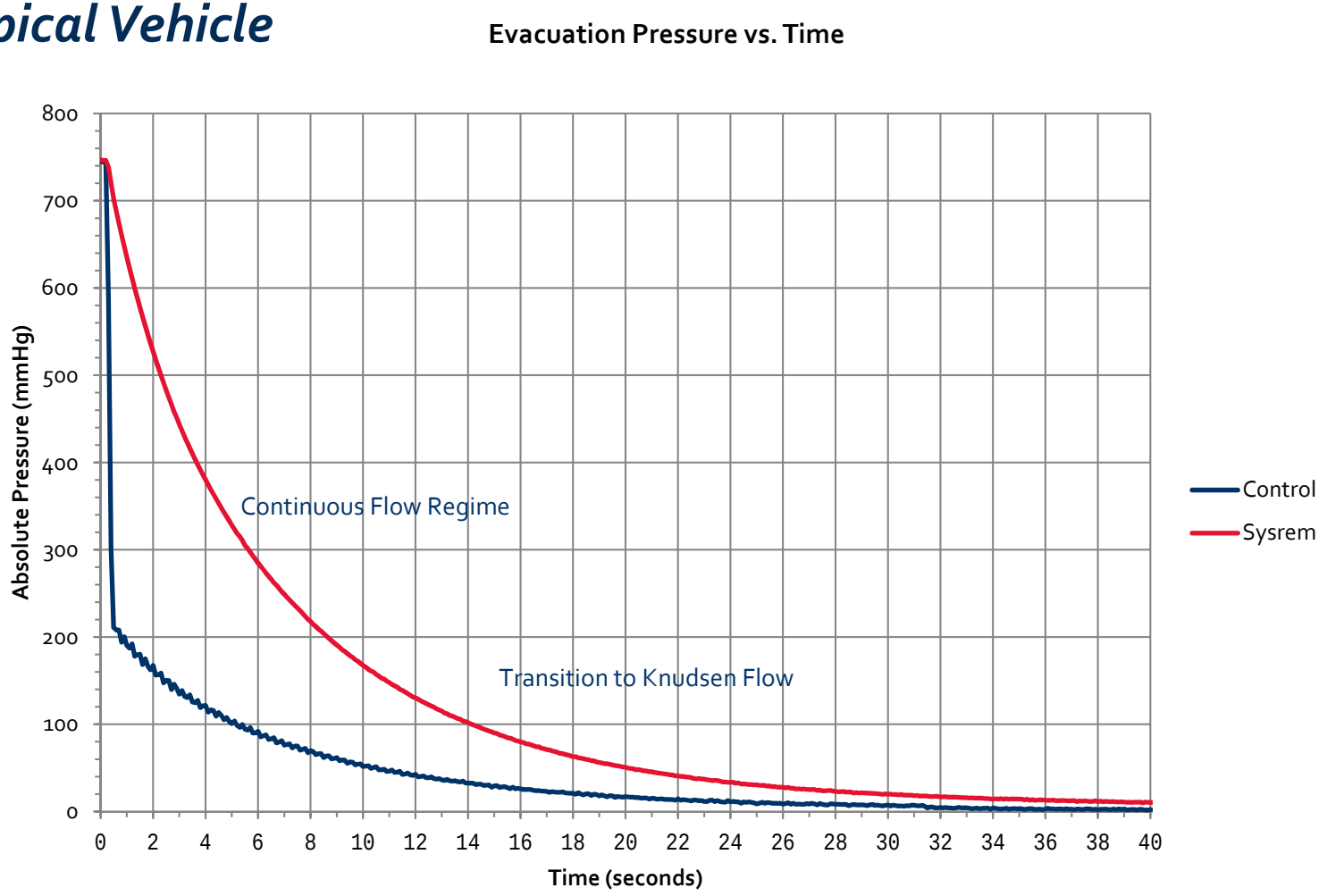
$$\bar{l} = \frac{k \cdot T}{\sqrt{2} \cdot \pi \cdot p \cdot d_m^2}$$



Evacuation Rate as a Function of Knudsen Number



Evacuation Time – Typical Vehicle



Schrader Test Setup

Charge Port Evacuation Trials