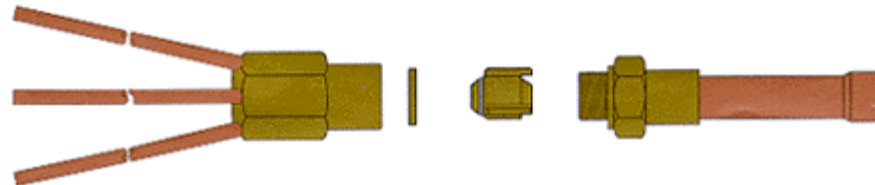




A Modern Approach to Selecting Capillary Tubes

Andy Schoen
Manager, Technical Services
Tecumseh Products Co.

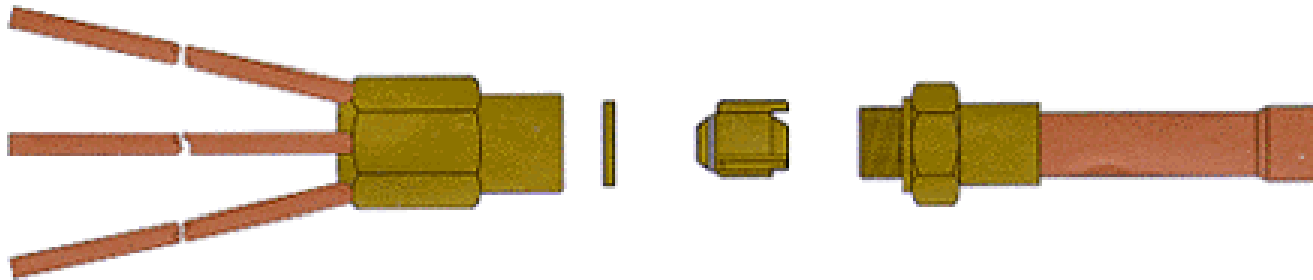
Expansion Devices



Hand Expansion Valve



Short Tube Restrictor



Automatic Expansion Valve



Thermostatic Expansion Valve



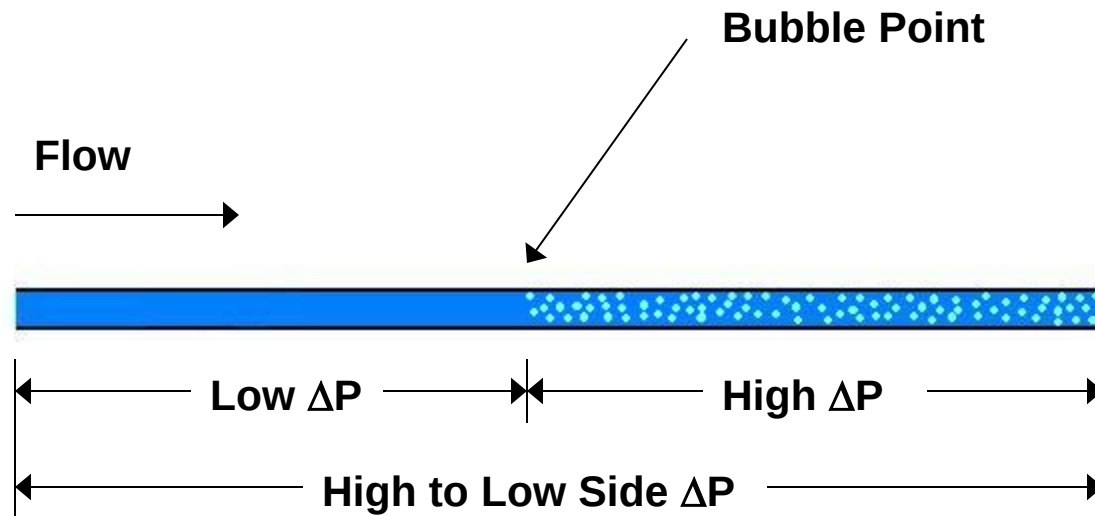
Electric Expansion Valve







Capillary Tube Flow



THEORY AND FIELD PROBLEMS OF THE CAPILLARY TUBE

By HENRY EHRENS
Sealed Unit Parts CO., Inc.

INTRODUCTION

The capillary or restrictor tube needs no formal introduction to refrigeration service or design engineers. In fact everyone in the refrigeration industry has either heard of, or has had some experience with the cap tube, as we shall call it from now on.

Of all the controls used in the refrigeration industry, if we pick out those that are used as pressure reducing devices, we find that they work the same way, in principle, in other industries. For instance, the automatic expansion valve is the same type of control used in reducing the pressure from oxy-acetylene tanks. The same type of valve is also used in water or air reduction. Some of the principles of the thermostatic expansion valve are also used in gas heating controls.

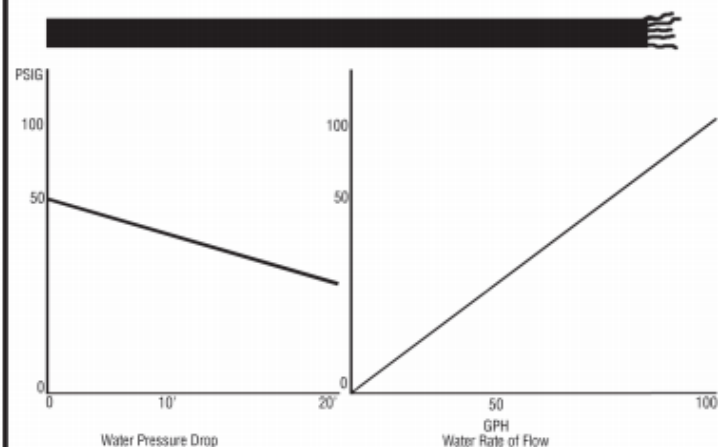
But when the cap tube is used in other industries it can only be used as a pressure reducing device, never as a controlling or regulating mechanism.

We shall see later on how a fixed length of tubing with a fixed bore can regulate the flow of refrigerant, and therefore can be classified as a refrigerant control.

What makes the cap tube unique to the refrigeration design engineer is that the cap tube is not an "off the shelf" item. In fact it

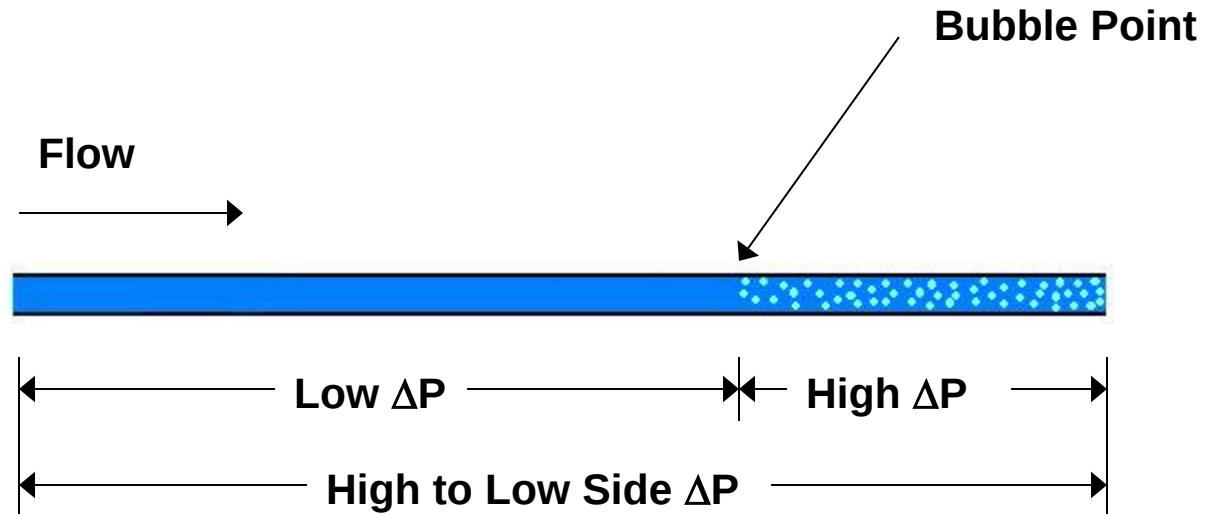
that can go wrong with a cap tube, is that it can become restricted or clogged, and it's always protected by a strainer to prevent this from happening.

But the cap tube does become clogged and restricted despite the strainer, which we will discuss after we look at the theory and principles of cap tubes.

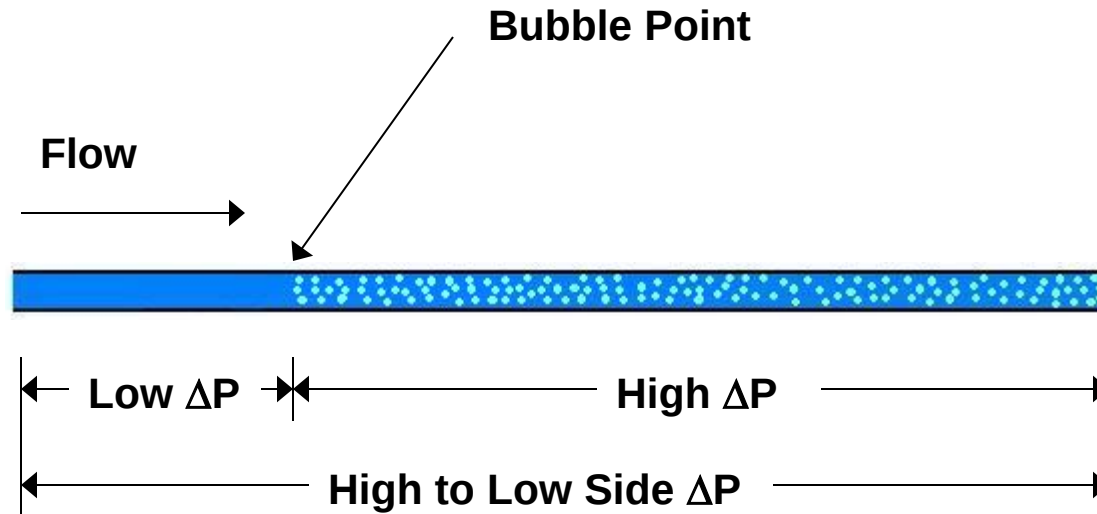




Lower Ambient Temperature



Higher Ambient Temperature





Supco Cap Tube Chart

SINGLE FEED

REF	HP	LOW	MED	HIGH
R12/R416A	1/8 HP	110" # 5	84" # 5	48" # 5
	1/6 HP	71" # 5	96" # 1	72" # 1
	1/5 HP	54" # 1	36" # 1	24" # 1
	1/4 HP	43" # 1	90" # 2	60" # 2
	1/3 HP	93" # 2	72" # 2	36" # 2
	1/2 HP	96" # 3	48" # 3	90" # 4
	3/4 HP	60" # 3	92" # 4	72" # 4
	1 HP	36" # 3	84" # 4	54" # 4
	1-1/2 HP	84" # 4	60" # 4	43" # 4
	2 HP	55" # 4	40" # 4	26" # 4
R134A / R401A	1/8 HP	121" # 5	92" #5	53" # 5
R401B/R406A	1/6 HP	78" # 5	106" #1	79" # 1
R409A/R500	1/5 HP	59" # 1	39" #1	26" # 1
	1/4 HP	47" # 1	99" #2	66" # 2
	1/3 HP	102" # 2	79" #2	39" # 2
	1/2 HP	105" # 3	52" # 3	99" # 4
	3/4 HP	66" # 3	101" #4	79" # 4
	1 HP	39" # 3	92" #4	59" # 4
	1-1/2 HP	92" # 4	66" #4	47" # 4
	2 HP	61" # 4	44" #4	29" # 4
R22	1/8 HP	132" # 5	101" # 5	58" # 5
	1/6 HP	86" # 5	116" # 1	86" # 1
	1/5 HP	64" # 1	42" # 1	28" # 1
	1/4 HP	51" # 1	109" # 2	72" # 2
	1/3 HP	112" # 2	87" # 2	43" # 2
	1/2 HP	115" # 3	57" # 3	109" # 4
	3/4 HP	72" # 3	111" # 4	87" # 4
	1 HP	42" # 3	101" # 4	65" # 4
	1-1/2 HP	101" # 4	72" # 4	51" # 4
	2 HP	67" # 4	48" # 4	32" # 4



J/B Cap Tube Chart

REFRIGERATION REFERENCE

Fan Cooled Units Only. Add

SINGLE FEED

H.P.	LOW		MED		HIGH	
R12 / R416A						
1/8	TC-26	110"	TC-26	84"	TC-26	48"
1/6	TC-26	71"	TC-31	96"	TC-31	72"
1/5	TC-31	54"	TC-31	36"	TC-31	24"
1/4	TC-31	43"	TC-42	90"	TC-42	60"
1/3	TC-42	93"	TC-42	72"	TC-42	36"
1/2	TC-49	96"	TC-49	48"	TC-64	90"
3/4	TC-49	60"	TC-64	92"	TC-64	72"
1	TC-49	36"	TC-64	84"	TC-64	54"
1-1/2	TC-64	84"	TC-64	60"	TC-64	43"
2	TC-64	55"	TC-64	40"	TC-64	26"
R134A / R401A / R401B / R406A, R409A / R500						
1/8	TC-26	121"	TC-26	92"	TC-26	53"
1/6	TC-26	78"	TC-31	106"	TC-31	79"
1/5	TC-31	59"	TC-31	39"	TC-31	26"
1/4	TC-31	47"	TC-42	99"	TC-42	66"
1/3	TC-42	102"	TC-42	79"	TC-42	39"
1/2	TC-49	105"	TC-49	52"	TC-64	99"
3/4	TC-49	66"	TC-64	101"	TC-64	79"
1	TC-49	39"	TC-64	92"	TC-64	59"
1-1/2	TC-64	92"	TC-64	66"	TC-64	47"
2	TC-64	61"	TC-64	44"	TC-64	29"



Cap Tube Sizing Problem

- Refrigerant R-134a
- Medium Temp Cooler
- 1/4 HP Compressor



Supco Cap Tube Chart

SINGLE FEED

REF	HP	LOW	MED	HIGH
R12/R416A	1/8 HP	110" # 5	84" # 5	48" # 5
	1/6 HP	71" # 5	96" # 1	72" # 1
	1/5 HP	54" # 1	36" # 1	24" # 1
	1/4 HP	43" # 1	90" # 2	60" # 2
	1/3 HP	93" # 2	72" # 2	36" # 2
	1/2 HP	96" # 3	48" # 3	90" # 4
	3/4 HP	60" # 3	92" # 4	72" # 4
	1 HP	36" # 3	84" # 4	54" # 4
	1-1/2 HP	84" # 4	60" # 4	43" # 4
	2 HP	55" # 4	40" # 4	26" # 4
R134A / R401A	1/8 HP	121" # 5	92" #5	53" # 5
R401B/R406A	1/6 HP	78" # 5	106" #1	79" # 1
R409A/R500	1/5 HP	59" # 1	39" #1	26" # 1
	1/4 HP	47" # 1	99" #2	66" # 2
	1/3 HP	102" # 2	79" #2	39" # 2
	1/2 HP	105" # 3	52" # 3	99" # 4
	3/4 HP	66" # 3	101" #4	79" # 4
	1 HP	39" # 3	92" #4	59" # 4
	1-1/2 HP	92" # 4	66" #4	47" # 4
	2 HP	61" # 4	44" #4	29" # 4
R22	1/8 HP	132" # 5	101" # 5	58" # 5
	1/6 HP	86" # 5	116" # 1	86" # 1
	1/5 HP	64" # 1	42" # 1	28" # 1
	1/4 HP	51" # 1	109" # 2	72" # 2
	1/3 HP	112" # 2	87" # 2	43" # 2
	1/2 HP	115" # 3	57" # 3	109" # 4
	3/4 HP	72" # 3	111" # 4	87" # 4
	1 HP	42" # 3	101" # 4	65" # 4
	1-1/2 HP	101" # 4	72" # 4	51" # 4
	2 HP	67" # 4	48" # 4	32" # 4



Compressor HP vs Rating

1/4 HP R-134a Commercial Temp Compressors

Model	Btu/h
TPA0421YXA	2050
TPA9421YXA	2075
TPA9423YXA	2320
AEA9423YXA	2390
TPB9423YAA	2675



Supco Cap Tube Chart

SINGLE FEED

REF	HP	LOW	MED	HIGH
R12/R416A	1/8 HP	110" # 5	84" # 5	48" # 5
	1/6 HP	71" # 5	96" # 1	72" # 1
	1/5 HP	54" # 1	36" # 1	24" # 1
	1/4 HP	43" # 1	90" # 2	60" # 2
	1/3 HP	93" # 2	72" # 2	36" # 2
	1/2 HP	96" # 3	48" # 3	90" # 4
	3/4 HP	60" # 3	92" # 4	72" # 4
	1 HP	36" # 3	84" # 4	54" # 4
	1-1/2 HP	84" # 4	60" # 4	43" # 4
	2 HP	55" # 4	40" # 4	26" # 4
R134A / R401A R401B/R406A R409A/R500	1/8 HP	121" # 5	92" #5	53" # 5
	1/6 HP	78" # 5	106" #1	79" # 1
	1/5 HP	59" # 1	39" #1	26" # 1
	1/4 HP	47" # 1	99" #2	66" # 2
	1/3 HP	102" # 2	79" #2	39" # 2
	1/2 HP	105" # 3	52" # 3	99" # 4
	3/4 HP	66" # 3	101" #4	79" # 4
	1 HP	39" # 3	92" #4	59" # 4
	1-1/2 HP	92" # 4	66" #4	47" # 4
	2 HP	61" # 4	44" #4	29" # 4
R22	1/8 HP	132" # 5	101" # 5	58" # 5
	1/6 HP	86" # 5	116" # 1	86" # 1
	1/5 HP	64" # 1	42" # 1	28" # 1
	1/4 HP	51" # 1	109" # 2	72" # 2
	1/3 HP	112" # 2	87" # 2	43" # 2
	1/2 HP	115" # 3	57" # 3	109" # 4
	3/4 HP	72" # 3	111" # 4	87" # 4
	1 HP	42" # 3	101" # 4	65" # 4
	1-1/2 HP	101" # 4	72" # 4	51" # 4
	2 HP	67" # 4	48" # 4	32" # 4

1995

$$\pi_8 = 1.8925\pi_1^{-0.484}\pi_2^{-0.824}\pi_4^{1.369}\pi_5^{0.0187}\pi_6^{0.773}\pi_7^{0.265}$$

where $\pi_5 = d_c^2 c_p \Delta t_{sc} / v_f^2 \mu_f^2$ and $2^\circ\text{F} < \Delta t_{sc} < 30^\circ\text{F}$.

2002

$$\pi_9 = 0.07602\pi_1^{-0.4583}\pi_3^{0.07751}\pi_5^{0.7342}\pi_6^{-0.1204}\pi_7^{0.03774}\pi_8^{-0.04085}\pi_{11}^{0.1768}$$

where $\pi_7 = \Delta T_{sc} C_{pfc} D_c^2 / \mu_{fc}^2 v_{fc}^2$ and $2^\circ\text{F} < \Delta T_{sc} < 30^\circ\text{F}$



Characteristics Considered

- Capillary Tube Length and ID
- Pressure (liquid and vapor)
- Density (liquid and vapor)
- Viscosity (liquid and vapor)
- Specific Heat (liquid and vapor)
- Surface Tension (liquid)
- Amount of Subcooling
- Latent Heat of Vaporization
- Heat Exchange Length



Edgar Buckingham





$$f(q_1, q_2, \dots, q_n) = 0$$

$$\pi_1 = f(\pi_2, \pi_3, \dots, \pi_{n-m})$$

$$\pi_1 = \pi_2^{a_1} \cdot \pi_3^{a_2} \cdot \dots \cdot \pi_{n-m}^{a_{(n-m-1)}}$$

15 Different Parameters

π Parameter	Definition	Description
π_1	L_c/D_c	Geometry effect
π_2	L_i/D_c	Geometry effect
π_3	L_{hx}/D_c	Geometry effect
π_4	D_s/D_c	Geometry effect
π_5	$P_{capin} D_c^2 / \mu_{fc}^2 v_{fc} T$	Inlet pressure
π_6	$P_{suctin} D_c^2 / \mu_{fc}^2 v_{fc}$	Inlet pressure
π_7 (subcooled)	$\Delta T_{sc} C_{pfc} D_c^2 / \mu_{fc}^2 v_{fc}^2$	Inlet condition
π_7 (quality)	$1 - x$	Inlet condition
π_8	$\Delta T_{sh} C_{pfc} D_c^2 / \mu_{fc}^2 v_{fc}^2$	Inlet condition
π_9	$\dot{m}/D_c \mu_{fc}$	Flow rate
π_{10}	v_{gc}/v_{fc}	Density effect
π_{11}	$(\mu_{fc} - \mu_{gc})/\mu_{fc}$	Viscous effect
π_{12}	$h_{fgc} D_c^2 / \mu_{fc}^2 v_{fc}^2$	Vaporization effect
π_{13}	μ_{gs}/μ_{fc}	Viscous effect
π_{14}	v_{gs}/v_{fc}	Density effect
π_{15}	C_{pgs}/C_{pfc}	Specific heat effect



Wolf and Pate 2002 Correlation

$$\pi_9 = 0.07602\pi_1^{-0.4583}\pi_3^{0.07751}\pi_5^{0.7342}\pi_6^{-0.1204}\pi_7^{0.03774}\pi_8^{-0.04085}\pi_{11}^{0.1768}$$

where $\pi_7 = \Delta T_{sc} C_{pfc} D_c^2 / \mu_{fc}^2 v_{fc}^2$ and $2^\circ\text{F} < \Delta T_{sc} < 30^\circ\text{F}$



Characteristics To Determine

- Capillary Tube Length and ID
- Pressure (liquid and vapor)
- Density (liquid and vapor)
- Viscosity (liquid and vapor)
- Specific Heat (liquid and vapor)
- Amount of Subcooling
- Latent Heat of Vaporization
- Heat Exchange Length



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http://www.boulder.nist.gov/div838/theory/refprop/Frequently_asked_questions.htm#Updates

Click [here](#) to view the PDF version of Users' Guide.

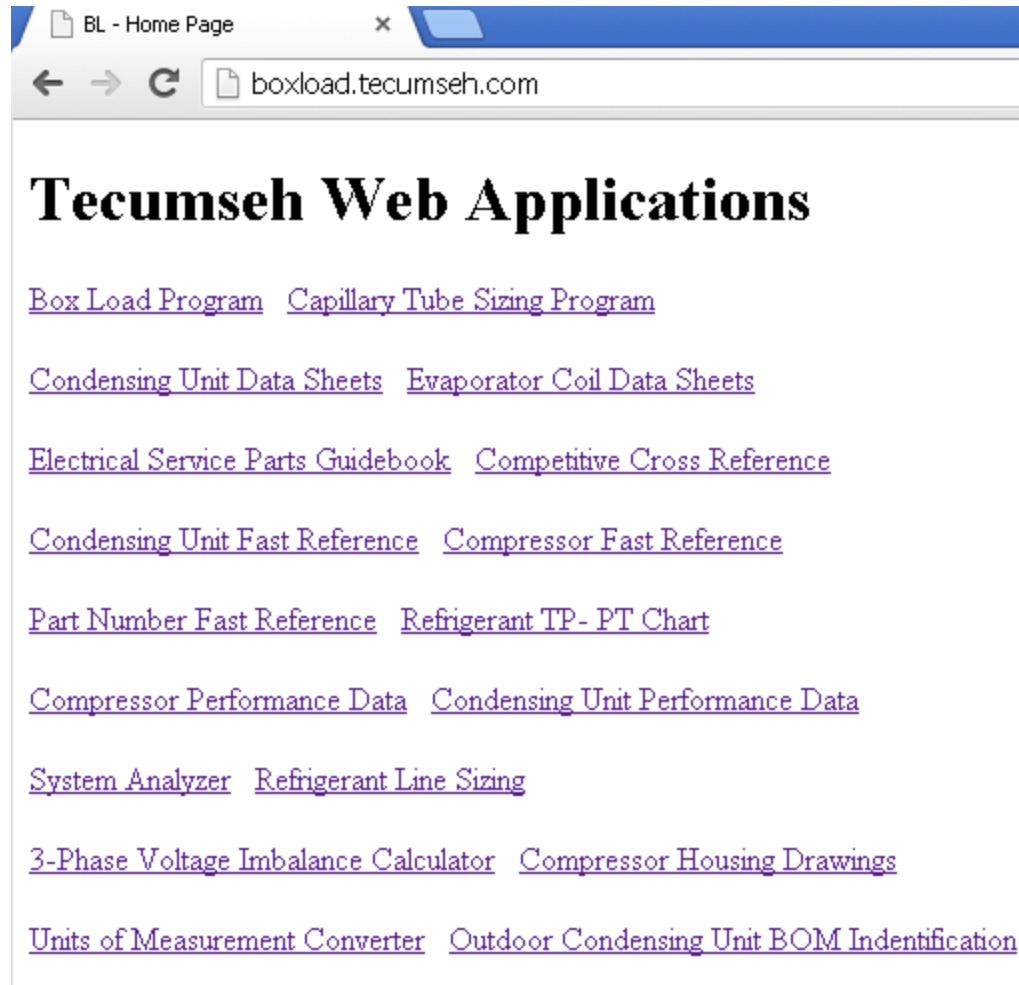
If you are having problems with the Online Purchase or Fax/Mail Order Link.

Price: \$200.00  

Upgrade Price: \$100.00  



Tecumseh Web App Site





Capillary Tube Sizing Web App

BL - Capillary Tube Sizing App x

← → ↻ boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement:	°F - in - Btu/h ▾	Evaporator Temp:	
Refrigerant:	134a ▾	Condensing Temp:	
Tube ID:	Auto Select ▾	Heat Exchange Length:	36
Select Compressor Model From List:	☐	System Capacity:	



Capillary Tube Sizing Web App

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← → ↻ boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement:	°F - in - Btu/h	Evaporator Temp:	
Refrigerant:	°F - in - Btu/h	Condensing Temp:	
Tube ID:	°F - in - HP	Heat Exchange Length:	36
Select Compressor Model:	°F - in - ton	System Capacity:	
	°C - in - Btu/h		
	°C - in - HP		
	°C - m - kW		
	°C - in - ton		



Capillary Tube Sizing Web App

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boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement: °F - in - Btu/h

Refrigerant: 134a

Tube ID: 134a

Select Compressor Model: 22, 23, 290, 401A, 401B, 404A, 407A, 407C, 407F, 408A, 409A, 410A, 414B, 422D, 437A, 438A, 502, 507

Select Clear Re

Evaporator Temp:

Condensing Temp:

Heat Exchange Length: 36

System Capacity:

List: ☐



Capillary Tube Sizing Web App

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boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement: °F - in - Btu/h

Refrigerant: 134a

Tube ID: Auto Select

Select Compressor Model

Evaporator Temp:

Condensing Temp:

Heat Exchange Length: 36

System Capacity:

Select Clear Re

0.028"
0.031"
0.036"
0.040"
0.042"
0.044"
0.046"
0.049"
0.050"
0.052"
0.054"
0.055"
0.059"
0.064"
0.070"
0.075"
0.080"
0.085"
0.090"
0.100"



Capillary Tube Sizing Web App

BL - Capillary Tube Sizing App x

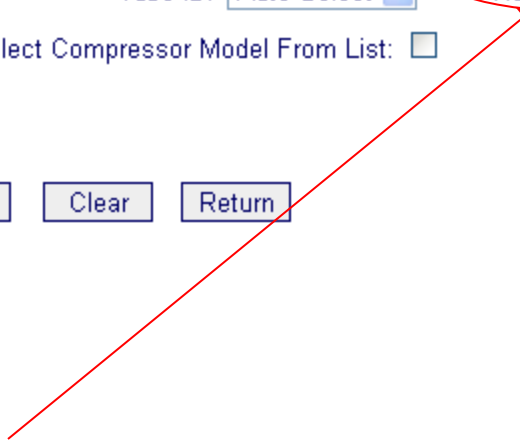
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Capillary Tube Selection

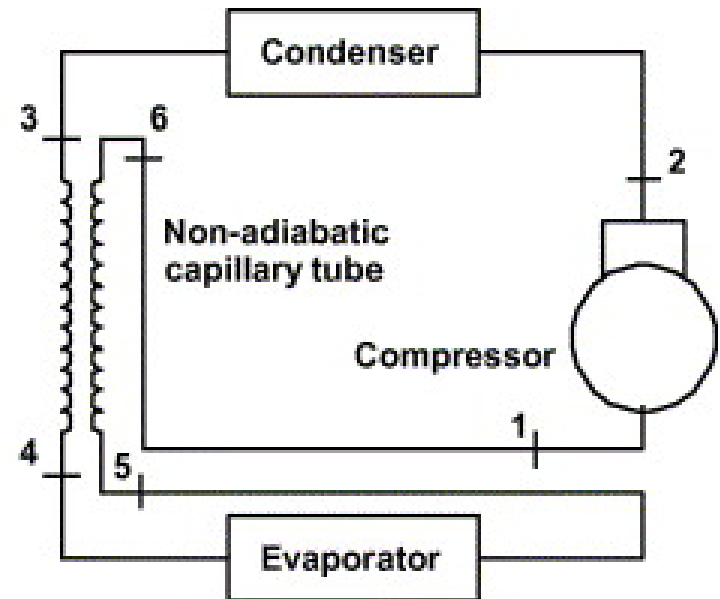
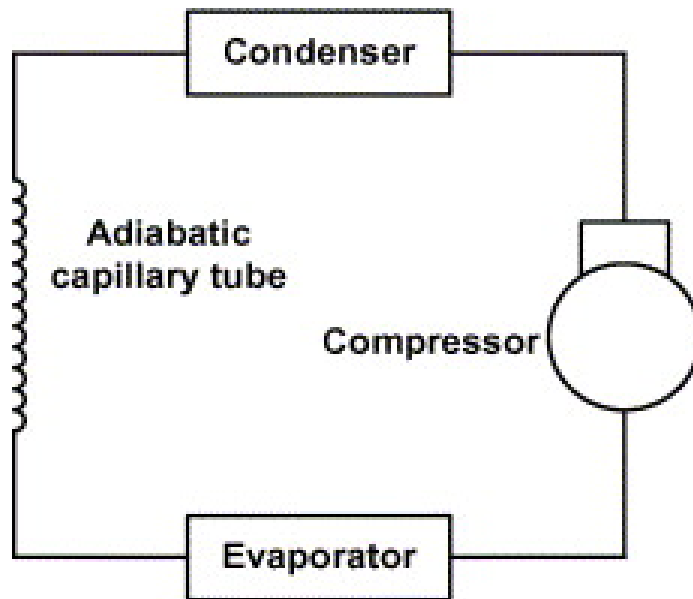
This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement:	°F - in - Btu/h	Evaporator Temp:	
Refrigerant:	134a	Condensing Temp:	
Tube ID:	Auto Select	Heat Exchange Length:	36
Select Compressor Model From List:	☐	System Capacity:	

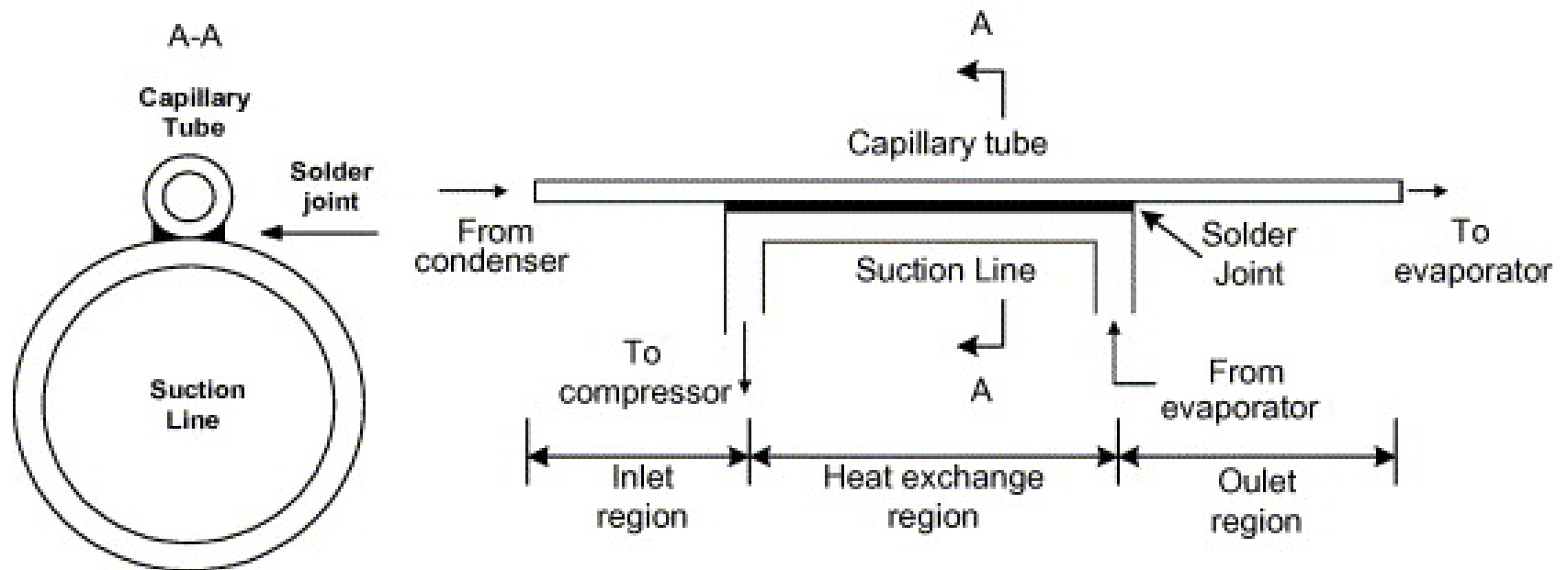
Select Clear Return

A red arrow originates from the bottom left of the form and points directly to the "Heat Exchange Length" input field, which contains the value "36". The input field is also circled in red.

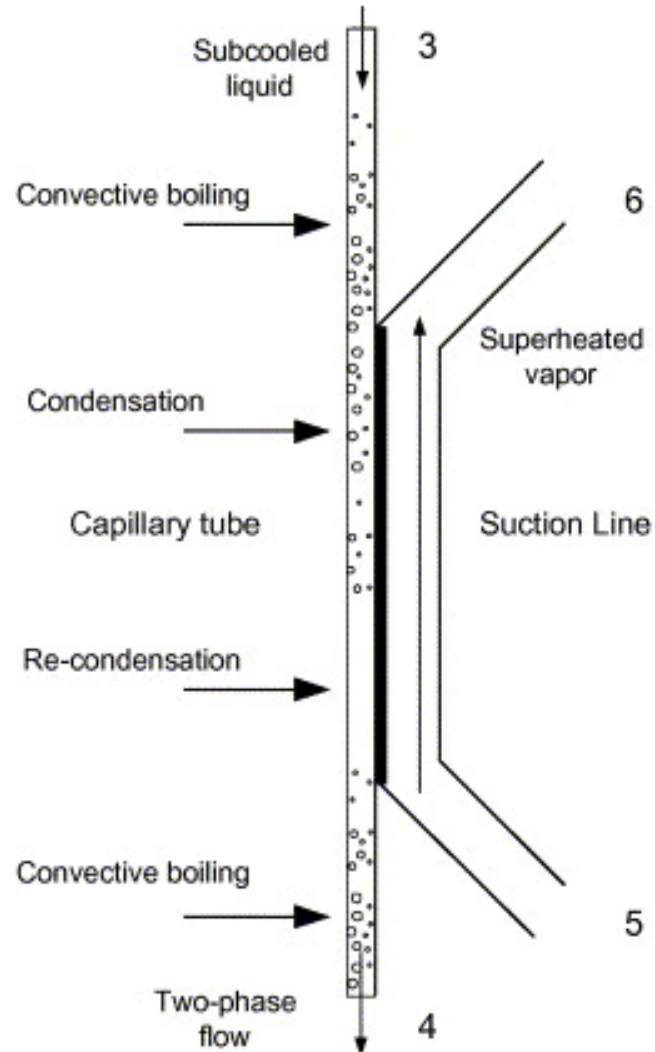
Adiabatic vs Non-adiabatic



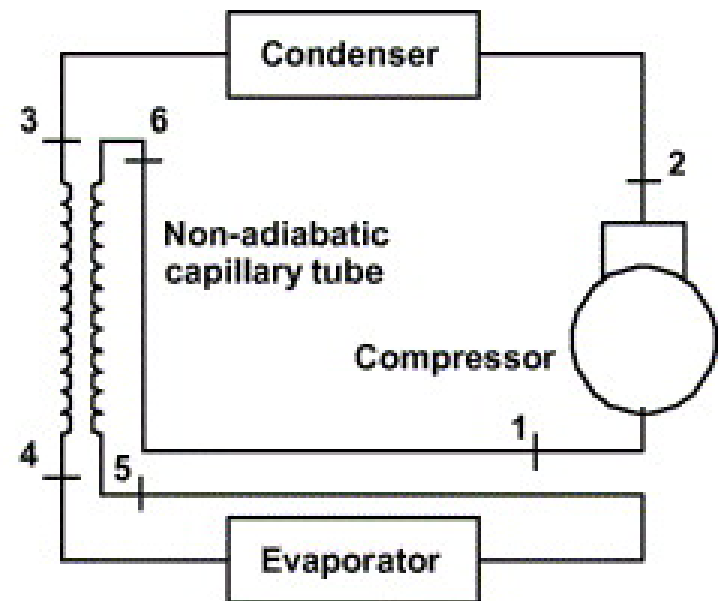
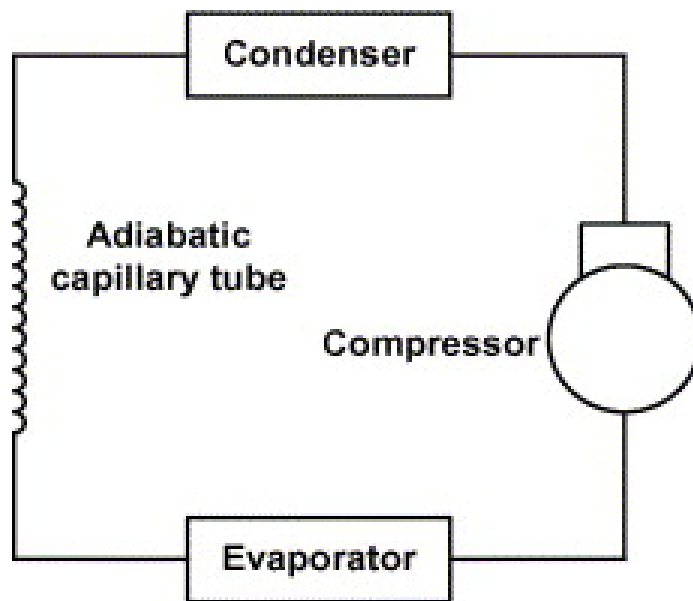
Heat Exchange Length



Heat Exchange Length

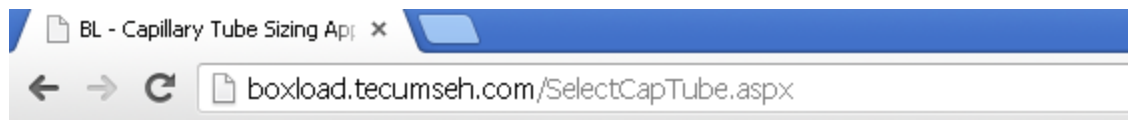


Why use heat exchange length?





Web App Selection using HP



Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement: °F - in - HP Evaporator Temp: 20

Refrigerant: 134a Condensing Temp: 120

Tube ID: Auto Select Heat Exchange Length: 36

Select Compressor Model From List: ☐ System Capacity: 0.25

Select Clear Return

Tube ID (in): 0.040"

Required Tube Length (in): 75

Compressor Model, Voltage, Pct Loading, Radius

TPA9421YXA	115/60/1	92.5	9.01
AEA4440YXD	208-230/60/1	96.1	4.64
AEA4440YXA	115/60/1	98.3	3.01
AEA3440YXA	115/60/1	98.3	3.00



Supco Cap Tube Chart

SINGLE FEED

REF	HP	LOW	MED	HIGH
R12/R416A	1/8 HP	110" # 5	84" # 5	48" # 5
	1/6 HP	71" # 5	96" # 1	72" # 1
	1/5 HP	54" # 1	36" # 1	24" # 1
	1/4 HP	43" # 1	90" # 2	60" # 2
	1/3 HP	93" # 2	72" # 2	36" # 2
	1/2 HP	96" # 3	48" # 3	90" # 4
	3/4 HP	60" # 3	92" # 4	72" # 4
	1 HP	36" # 3	84" # 4	54" # 4
	1-1/2 HP	84" # 4	60" # 4	43" # 4
	2 HP	55" # 4	40" # 4	26" # 4
R134A / R401A	1/8 HP	121" # 5	92" #5	53" # 5
R401B/R406A	1/6 HP	78" # 5	106" #1	79" # 1
R409A/R500	1/5 HP	59" # 1	39" #1	26" # 1
	1/4 HP	47" # 1	99" #2	66" # 2
	1/3 HP	102" # 2	79" #2	39" # 2
	1/2 HP	105" # 3	52" # 3	99" # 4
	3/4 HP	66" # 3	101" #4	79" # 4
	1 HP	39" # 3	92" #4	59" # 4
	1-1/2 HP	92" # 4	66" #4	47" # 4
	2 HP	61" # 4	44" #4	29" # 4
R22	1/8 HP	132" # 5	101" # 5	58" # 5
	1/6 HP	86" # 5	116" # 1	86" # 1
	1/5 HP	64" # 1	42" # 1	28" # 1
	1/4 HP	51" # 1	109" # 2	72" # 2
	1/3 HP	112" # 2	87" # 2	43" # 2
	1/2 HP	115" # 3	57" # 3	109" # 4
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	1 HP	42" # 3	101" # 4	65" # 4
	1-1/2 HP	101" # 4	72" # 4	51" # 4
	2 HP	67" # 4	48" # 4	32" # 4



Web App Selection using HP

BL - Capillary Tube Sizing App

boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement: °F - in - HP

Refrigerant: 134a

Tube ID: 0.040"

Select Compressor Model From List: ☐

Evaporator Temp: 20

Condensing Temp: 120

Heat Exchange Length: 6

System Capacity: 0.25

Select

Clear

Return

Tube ID (in): 0.040"

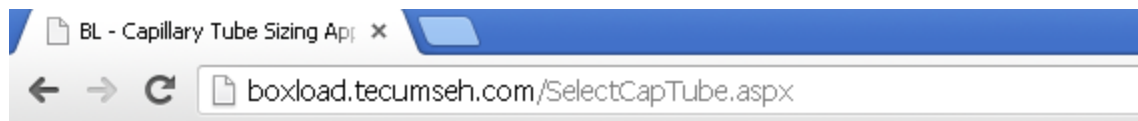
Required Tube Length (in): 56

Compressor Model, Voltage, Pct Loading, Radius

TPA9421YXA	115/60/1	92.5	9.01
AEA4440YXD	208-230/60/1	96.1	4.64
AEA4440YXA	115/60/1	98.3	3.01
AEA3440YXA	115/60/1	98.3	3.00



R401A Selection using HP



Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement:	°F - in - HP	Evaporator Temp:	20
Refrigerant:	401A	Condensing Temp:	120
Tube ID:	Auto Select	Heat Exchange Length:	36
Select Compressor Model From List:	☐	System Capacity:	0.25

Select Clear Return

Tube ID (in): 0.040"

Required Tube Length (in): 107

Compressor Model, Voltage, Pct Loading, Radius

AEA3430AXA	115/60/1	93.8	6.26
AEA4430AXA	115/60/1	94.4	5.73



R401A Selection using HP

BL - Capillary Tube Sizing App x

boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement:	°F - in - HP	Evaporator Temp:	20
Refrigerant:	401A	Condensing Temp:	120
Tube ID:	Auto Select	Heat Exchange Length:	0
Select Compressor Model From List:	☐	System Capacity:	0.25

Select Clear Return

Tube ID (in): 0.040" **Required Tube Length (in): 107**



R401A Selection using HP

BL - Capillary Tube Sizing App x

boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement: °F - in - HP

Refrigerant: 401A

Tube ID: 0.040"

Select Compressor Model From List: ☐

Evaporator Temp: 20

Condensing Temp: 120

Heat Exchange Length: 6

System Capacity: 0.25

Select Clear Return

Tube ID (in): 0.040" **Required Tube Length (in): 79**

Compressor Model, Voltage, Pct Loading, Radius

AEA3430AXA	115/60/1	93.8	6.26
AEA4430AXA	115/60/1	94.4	5.73



TPA9423YXA

TECUMSEH PRODUCTS COMPANY COMPRESSOR PERFORMANCE DATA

3/17/2003
TEST VOLTAGE: 115
MOTOR TYPE: CSIR
RUN CAP: mfd

RETURN GAS 40
SUB COOLING 0
AMBIENT 95
FORCED AIR: Yes

TPA9423YXA
115/60/1
R - 134a

EVAP TEMP		CONDENSING TEMPERATURE (°F)				
		100	110	120	130	140
0	BTUH	1608	1475	1343	1211	1081
	WATTS	355	356	358	360	361
	AMPS	6.31	6.30	6.28	6.26	6.24
	LB/HR	24.1	23.2	22.2	21.3	20.3
5	BTUH	1855	1691	1527	1364	1201
	WATTS	377	381	384	388	391
	AMPS	6.36	6.36	6.35	6.34	6.33
	LB/HR	28.2	27.1	25.9	24.7	23.4
10	BTUH	2142	1948	1753	1559	1366
	WATTS	402	408	413	419	424
	AMPS	6.47	6.49	6.49	6.50	6.50
	LB/HR	33.0	31.6	30.1	28.7	27.2
15	BTUH	2467	2243	2019	1795	1571
	WATTS	428	436	444	452	460
	AMPS	6.62	6.65	6.68	6.71	6.73
	LB/HR	38.1	36.6	34.9	33.3	31.6
20	BTUH	2826	2573	2320	2067	1813
	WATTS	456	467	477	487	497
	AMPS	6.78	6.84	6.90	6.95	7.00
	LB/HR	43.7	41.9	40.1	38.3	36.4
25	BTUH	3218	2936	2655	2373	2091
	WATTS	484	497	510	523	536
	AMPS	6.93	7.03	7.12	7.20	7.28
	LB/HR	49.4	47.5	45.6	43.6	41.6
30	BTUH	3638	3329	3020	2711	2401
	WATTS	511	528	544	559	575
	AMPS	7.04	7.18	7.31	7.44	7.55
	LB/HR	55.3	53.3	51.2	49.2	47.0

Performance rated at 20ET/ 120CT/ 0SC/ 40 return



TPA9423YXA Selection at AHRI CBP

BL - Capillary Tube Sizing App

boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement: °F - in - Btu/h

Refrigerant: 134a

Tube ID: Auto Select

Select Compressor Model From List: ☐

Evaporator Temp: 20

Condensing Temp: 120

Heat Exchange Length: 36

System Capacity: 2320

Select Clear Return

Tube ID (in): 0.040" **Required Tube Length (in): 55**

Compressor Model, Voltage, Pct Loading, Radius

TPA9423YXA	115/60/1	96.0	6.43
TPA9423YXA	115/60/1	96.0	6.39
AE4440Y-AA1A	115/60/1	98.5	7.17
AE3440Y-AA1A	115/60/1	99.2	7.04



TPA9423YXA

TECUMSEH PRODUCTS COMPANY COMPRESSOR PERFORMANCE DATA

3/17/2003
TEST VOLTAGE: 115
MOTOR TYPE: CSIR
RUN CAP: mfd

RETURN GAS 40
SUB COOLING 0
AMBIENT 95
FORCED AIR: Yes

TPA9423YXA
115/60/1
R - 134a

EVAP TEMP		CONDENSING TEMPERATURE (°F)				
		100	110	120	130	140
0	BTUH	1608	1475	1343	1211	1081
	WATTS	355	356	358	360	361
	AMPS	6.31	6.30	6.28	6.26	6.24
	LB/HR	24.1	23.2	22.2	21.3	20.3
5	BTUH	1855	1691	1527	1364	1201
	WATTS	377	381	384	388	391
	AMPS	6.36	6.36	6.35	6.34	6.33
	LB/HR	28.2	27.1	25.9	24.7	23.4
10	BTUH	2142	1948	1753	1559	1366
	WATTS	402	408	413	419	424
	AMPS	6.47	6.49	6.49	6.50	6.50
	LB/HR	33.0	31.6	30.1	28.7	27.2
15	BTUH	2467	2243	2019	1795	1571
	WATTS	428	436	444	452	460
	AMPS	6.62	6.65	6.68	6.71	6.73
	LB/HR	38.1	36.6	34.9	33.3	31.6
20	BTUH	2826	2573	2320	2067	1813
	WATTS	456	467	477	487	497
	AMPS	6.78	6.84	6.90	6.95	7.00
	LB/HR	43.7	41.9	40.1	38.3	36.4
25	BTUH	3218	2936	2655	2373	2091
	WATTS	484	497	510	523	536
	AMPS	6.93	7.03	7.12	7.20	7.28
	LB/HR	49.4	47.5	45.6	43.6	41.6
30	BTUH	3638	3329	3020	2711	2401
	WATTS	511	528	544	559	575
	AMPS	7.04	7.18	7.31	7.44	7.55
	LB/HR	55.3	53.3	51.2	49.2	47.0

Performance rated at 20ET/ 120CT/ 0SC/ 40 return



TPA9423YXA Selection @ 25°F/110°F

BL - Capillary Tube Sizing App x

boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement: °F - in - Btu/h ▾

Refrigerant: 134a ▾

Tube ID: Auto Select ▾

Select Compressor Model From List: ☐

Evaporator Temp: 25

Condensing Temp: 110

Heat Exchange Length: 36

System Capacity: 2936

Select Clear Return

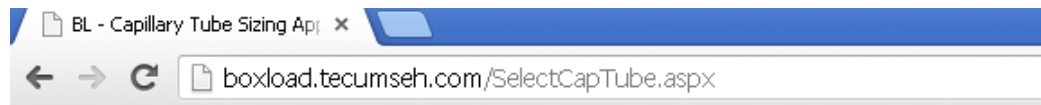
Tube ID (in): 0.052" **Required Tube Length (in): 137**

Compressor Model, Voltage, Pct Loading, Radius

AEA4448YXA	115/60/1	94.6	9.26
TPA9423YXA	115/60/1	95.8	10.86
TPA9423YXA	115/60/1	96.2	10.69
AE3440Y-AA1A	115/60/1	100.3	2.03



Cap Tube Selection using Comp Model



Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement: °F - in - Btu/h

Evaporator Temp: 25

Refrigerant: 134a

Condensing Temp: 110

Tube ID: Auto Select

Heat Exchange Length: 36

Select Compressor Model From List: ☒

Compressor Model: TPA9423YXA

Select

Clear

Return

Tube ID (in): 0.052"

Required Tube Length (in)

- TPA9423YXA
- TPA9421YXA
- AZA0395YXA
- AZA0370YXA
- AKA4476YXD
- AKA4476YXA
- AKA4460YXD
- AKA4460YXA
- AJA7461YXD
- AJA7461YXA
- AJA4512YXD
- AJA4492YXD
- AJA4492YXA
- AEA4448YXA
- AEA4440YXD
- AEA4440YXA
- AEA4430YXA



Cap Tube Selection using Comp Model

BL - Capillary Tube Sizing App x

boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement:	°F - in - Btu/h	Evaporator Temp:	25
Refrigerant:	134a	Condensing Temp:	110
Tube ID:	Auto Select	Heat Exchange Length:	36
Select Compressor Model From List:	☒	Compressor Model:	TPA9423YXA

Select Clear Return

Tube ID (in): 0.052" **Required Tube Length (in): 124**



Cap Tube Selection using Comp Model

BL - Capillary Tube Sizing App x

boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement:	°F - in - Btu/h	Evaporator Temp:	25
Refrigerant:	134a	Condensing Temp:	110
Tube ID:	Auto Select	Heat Exchange Length:	0
Select Compressor Model From List:	☒	Compressor Model:	TPA9423YXA

Select Clear Return



Cap Tube Selection using Comp Model

BL - Capillary Tube Sizing App x

boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement:	°F - in - Btu/h	Evaporator Temp:	25
Refrigerant:	134a	Condensing Temp:	110
Tube ID:	Auto Select	Heat Exchange Length:	6
Select Compressor Model From List:	☒	Compressor Model:	TPA9423YXA

Select Clear Return

Tube ID (in): 0.040" **Required Tube Length (in): 21**



Supco Cap Tube Chart

SINGLE FEED

REF	HP	LOW	MED	HIGH
R12/R416A	1/8 HP	110" # 5	84" # 5	48" # 5
	1/6 HP	71" # 5	96" # 1	72" # 1
	1/5 HP	54" # 1	36" # 1	24" # 1
	1/4 HP	43" # 1	90" # 2	60" # 2
	1/3 HP	93" # 2	72" # 2	36" # 2
	1/2 HP	96" # 3	48" # 3	90" # 4
	3/4 HP	60" # 3	92" # 4	72" # 4
	1 HP	36" # 3	84" # 4	54" # 4
	1-1/2 HP	84" # 4	60" # 4	43" # 4
	2 HP	55" # 4	40" # 4	26" # 4
R134A / R401A	1/8 HP	121" # 5	92" #5	53" # 5
R401B/R406A	1/6 HP	78" # 5	106" #1	79" # 1
R409A/R500	1/5 HP	59" # 1	39" #1	26" # 1
	1/4 HP	47" # 1	99" #2	66" # 2
	1/3 HP	102" # 2	79" #2	39" # 2
	1/2 HP	105" # 3	52" # 3	99" # 4
	3/4 HP	66" # 3	101" #4	79" # 4
	1 HP	39" # 3	92" #4	59" # 4
	1-1/2 HP	92" # 4	66" #4	47" # 4
	2 HP	61" # 4	44" #4	29" # 4
R22	1/8 HP	132" # 5	101" # 5	58" # 5
	1/6 HP	86" # 5	116" # 1	86" # 1
	1/5 HP	64" # 1	42" # 1	28" # 1
	1/4 HP	51" # 1	109" # 2	72" # 2
	1/3 HP	112" # 2	87" # 2	43" # 2
	1/2 HP	115" # 3	57" # 3	109" # 4
	3/4 HP	72" # 3	111" # 4	87" # 4
	1 HP	42" # 3	101" # 4	65" # 4
	1-1/2 HP	101" # 4	72" # 4	51" # 4
	2 HP	67" # 4	48" # 4	32" # 4



Cap Tube Selection using Comp Model

BL - Capillary Tube Sizing App x

boxload.tecumseh.com/SelectCapTube.aspx

Capillary Tube Selection

This calculator uses the Wolf and Pate 2002 correlation

Units of Measurement:	°F - in - Btu/h	Evaporator Temp:	25
Refrigerant:	134a	Condensing Temp:	110
Tube ID:	0.052"	Heat Exchange Length:	6
Select Compressor Model From List:	☒	Compressor Model:	TPA9423YXA

Select Clear Return

Tube ID (in): 0.052" **Required Tube Length (in): 92**

Cap Tube Chart using Btu/h

Capillary Tube

Table A-1: Capillary tube selections assume a 115°F (46°C) liquid temperature and 3 ft of heat exchange length

		Capillary Tube, Length - OD		
		Evaporator Temperature, °F (°C)		
Refrigerant	Btu/h per circuit	-10 (-23)	20 (-7)	45 (7)
R134a	500	0.028" - 17 ft	0.028" - 17 ft	0.028" - 17 ft
	750	0.028" - 7 ft	0.028" - 7 ft	0.028" - 7 ft
	1000	0.031" - 6½ ft	0.031" - 6½ ft	0.031" - 6½ ft
	1250	0.040" - 17½ ft	0.040" - 17½ ft	0.040" - 17½ ft
	1500	0.040" - 12 ft	0.040" - 12 ft	0.040" - 12 ft
	2000	0.040" - 6½ ft	0.040" - 6½ ft	0.040" - 6½ ft
	3000	0.052" - 11½ ft	0.052" - 11½ ft	0.052" - 11½ ft
	4000	0.052" - 6 ft	0.052" - 6 ft	0.052" - 6 ft
	6000	0.064" - 8 ft	0.064" - 8 ft	0.064" - 8 ft
	8000	0.064" - 4½ ft	0.064" - 4½ ft	0.064" - 4½ ft
	10000	0.064" - 12½ ft (2)	0.064" - 12½ ft (2)	0.064" - 12½ ft (2)
	12000	0.064" - 8 ft (2)	0.064" - 8 ft (2)	0.064" - 8 ft (2)

