Optimized Hermetic Condensing Units To Meet DOE & EPA Regulations

Launch Package

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Commercial Refrigeration Equipment
Equipment Classes

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

- Low- or Medium-Temperature
- Vertical, Semi-Vertical, Horizontal or Service Over Counter
- Self-Contained or Remote Condensing
- With or Without Solid/Transparent Doors
- Commercial Refrigerator and Freezer

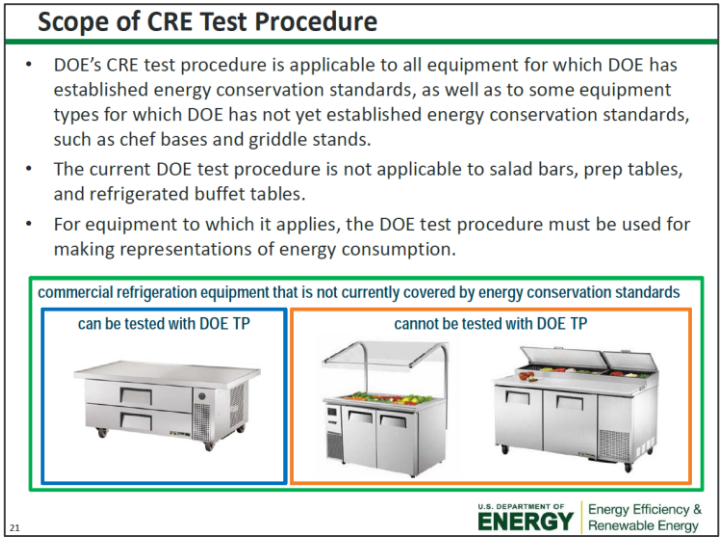
33+ Classes of Equipment
20+ Sizes/Eqp. Class

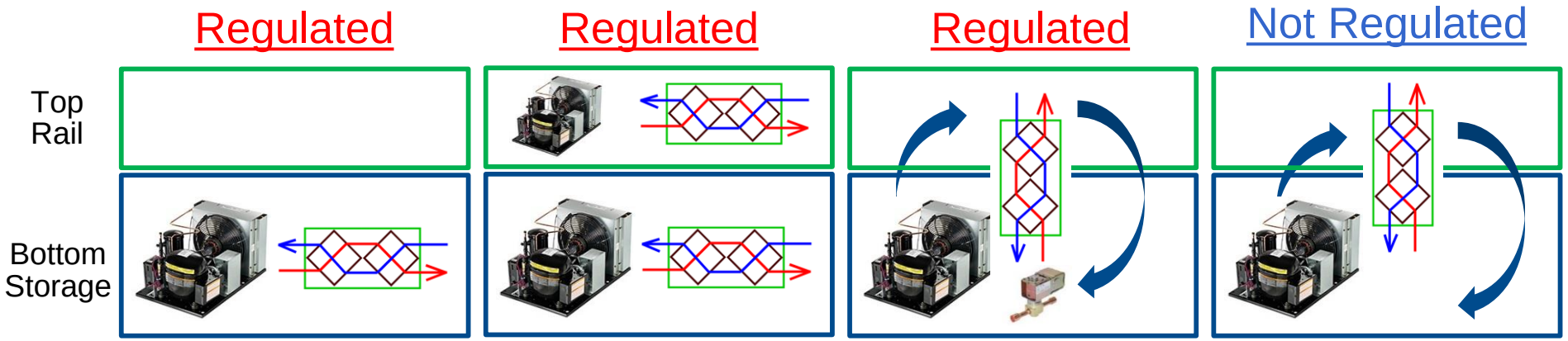
Equipment Affected

Buffet Tables, Salad Bars, Prep Tables Not Affected Depending Upon Refrigeration Construction

Source: Department of Energy

Buffet Tables, Salad Bars, Prep Tables Beyond
Scope of Energy Mandates





Source: Department of Energy

CRE Equipment DOE Analysis and Equations

- X-axis: size of equipment ft^3
- Y-axis: energy draw kWh/day
- Equation format: Y = m(x) + b
- kWh = $m(ft^3)$ + b

- 33 classes of equipment
- Remote condensing and self-contained open cases will not require major efficiency improvement challenges
- Self-contained vertical reach-ins will require significant efficiency improvement changes

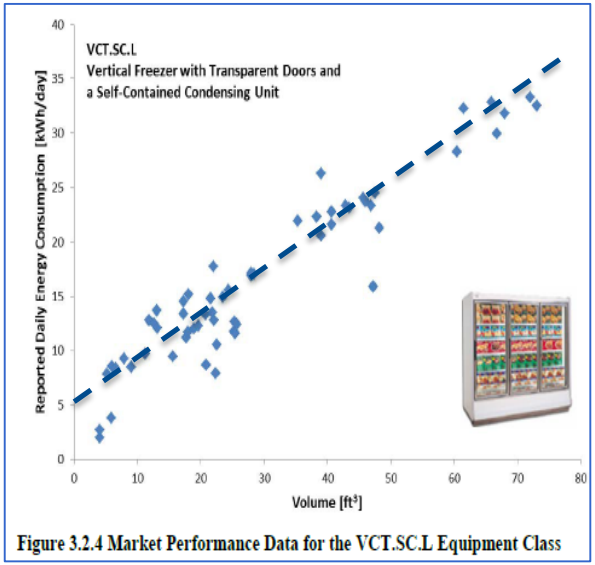


Figure 3.2.4 Market Performance Data for the VCT.SC.L Equipment Class

	Equations			y-Intercept				Slope			
	2010	2012	2017	2010	2012	2017	% Delta	2010	2012	2017	% Delta
VOP.RC.M		0.82 x TDA + 4.07	0.64 x TDA + 4.07		4.07	4.07	0%		0.82	0.64	-22%
VOP.RC.L		2.27 x TDA + 6.85	2.2 x TDA + 6.85		6.85	6.85	0%		2.27	2.2	-3%
SVO.RC.M		0.83 x TDA + 3.18	0.66 x TDA + 3.18		3.18	3.18	0%		0.83	0.66	-20%
SVO.RC.L		2.27 x TDA + 6.85	2.2 x TDA + 6.85		6.85	6.85	0%		2.27	2.2	-3%
HZO.RC.M		0.35 x TDA + 2.88	0.35 x TDA + 2.88		2.88	2.88	0%		0.35	0.35	0%
HZO.RC.L		0.57 x TDA + 6.88	0.55 x TDA + 6.88		6.88	6.88	0%		0.57	0.55	-4%
VCT.RC.M		0.22 x TDA + 1.95	0.15 x TDA + 1.95		1.95	1.95	0%		0.22	0.15	-32%
VCT.RC.L		0.56 x TDA + 2.61	0.49 x TDA + 2.61		2.61	2.61	0%		0.56	0.49	-13%
HCT.RC.M		0.16 x TDA + 0.13	0.16 x TDA + 0.13		0.13	0.13	0%		0.16	0.16	0%
HCT.RC.L		0.34 x TDA + 0.26	0.34 x TDA + 0.26		0.26	0.26	0%		0.34	0.34	0%
VCS.RC.M		0.11 x V + 0.26	0.1 x V + 0.26		0.26	0.26	0%		0.11	0.1	-9%
VCS.RC.L		0.23 x V + 0.54	0.21 x V + 0.54		0.54	0.54	0%		0.23	0.21	-9%
HCS.RC.M		0.11 x V + 0.26	0.1 x V + 0.26		0.26	0.26	0%		0.11	0.1	-9%
HCS.RC.L		0.23 x V + 0.54	0.21 x V + 0.54		0.54	0.54	0%		0.23	0.21	-9%
SOC.RC.M		0.51 x TDA + 0.11	0.44 x TDA + 0.11		0.11	0.11	0%		0.51	0.44	-14%
SOC.RC.L		1.08 x TDA + 0.22	0.93 x TDA + 0.22		0.22	0.22	0%		1.08	0.93	-14%
VOP.SC.M		1.74 x TDA + 4.71	1.69 x TDA + 4.71		4.71	4.71	0%		1.74	1.69	-3%
VOP.SC.L		4.37 x TDA + 11.82	4.25 x TDA + 11.82		1.82	1.82	0%		4.37	4.25	-3%
SVO.SC.M		1.73 x TDA + 4.59	1.7 x TDA + 4.59		4.59	4.59	0%		1.73	1.7	-2%
SVO.SC.L		4.34 x TDA + 11.51	4.26 x TDA + 11.51		1.51	1.51	0%		4.34	4.26	-2%
HZO.SC.M		0.77 x TDA + 5.55	0.72 x TDA + 5.55		5.55	5.55	0%		0.77	0.72	-6%
HZO.SC.L		1.92 x TDA + 7.08	1.9 x TDA + 7.08		7.08	7.08	0%		1.92	1.9	-1%
VCT.SC.M	0.12 V + 3.34		0.1 x V + 0.86	3.34		0.86	-74%	0.12		0.1	-17%
VCT.SC.L	0.75 V + 4.10		0.29 x V + 2.95	4.1		2.95	-28%	0.75		0.29	-61%
VCS.SC.M	0.10 V + 2.04		0.05 x V + 1.36	2.04		1.36	-33%	0.10		0.05	-50%
VCS.SC.L	0.40 V + 1.38		0.22 x V + 1.38	1.38		1.38	0%	0.40		0.22	-45%

Source: Department of Energy

EPA's Final Rule

Phase out dates / Likely alternatives

Summary of most commonly used refrigerants

Phase-out Refrigerant	*Super-Market* New*	Super-market Retrofit**	Remote *CDU* New	Remote *CDU* Retrofit**	Standalone			
					MT, <2200BTU/hr. and no flooded evap. New	*MT, >2200BTU/hr. or contain flooded evap.* New	*LT* New	*LT & MT* Retrofit* *
R-404A/507A	Jan. 1 2017	July 20 2016	Jan. 1 2018	July 20 2016	2019	2020	2020	July 20 2016
R-410A	OK	-	OK	-	2019	2020	2020	-
R-407A/C/F	OK	OK	OK	OK	2019	2020	2020	OK
HFC-134a	OK	OK	OK	OK	2019	2020	OK	OK
Likely Alternatives								
R-448A/449A	OK	OK	OK	OK	Neither SNAP-approved, nor banned	Neither SNAP-approved, nor banned	OK	OK for LT only
R-450A/513A	OK	OK	OK	OK	OK	OK	OK	OK
R-290	-	-	-	-	OK	OK	OK	-
R-744	OK	-	OK	-	OK	OK	OK	-
R-717	OK (in primary loop of secondary CO2 sys.)	-	OK (in primary loop of secondary CO2 sys.)	-	-	-	-	-

*** Includes ICE machines connected to a supermarket rack refrigeration system.**

*** * EPA uses term "retrofit" to indicate the use of a refrigerant in an appliance that was designed for and originally operated using a different refrigerant .Term does not apply to upgrades to existing equipment where the refrigerant is not changed.**

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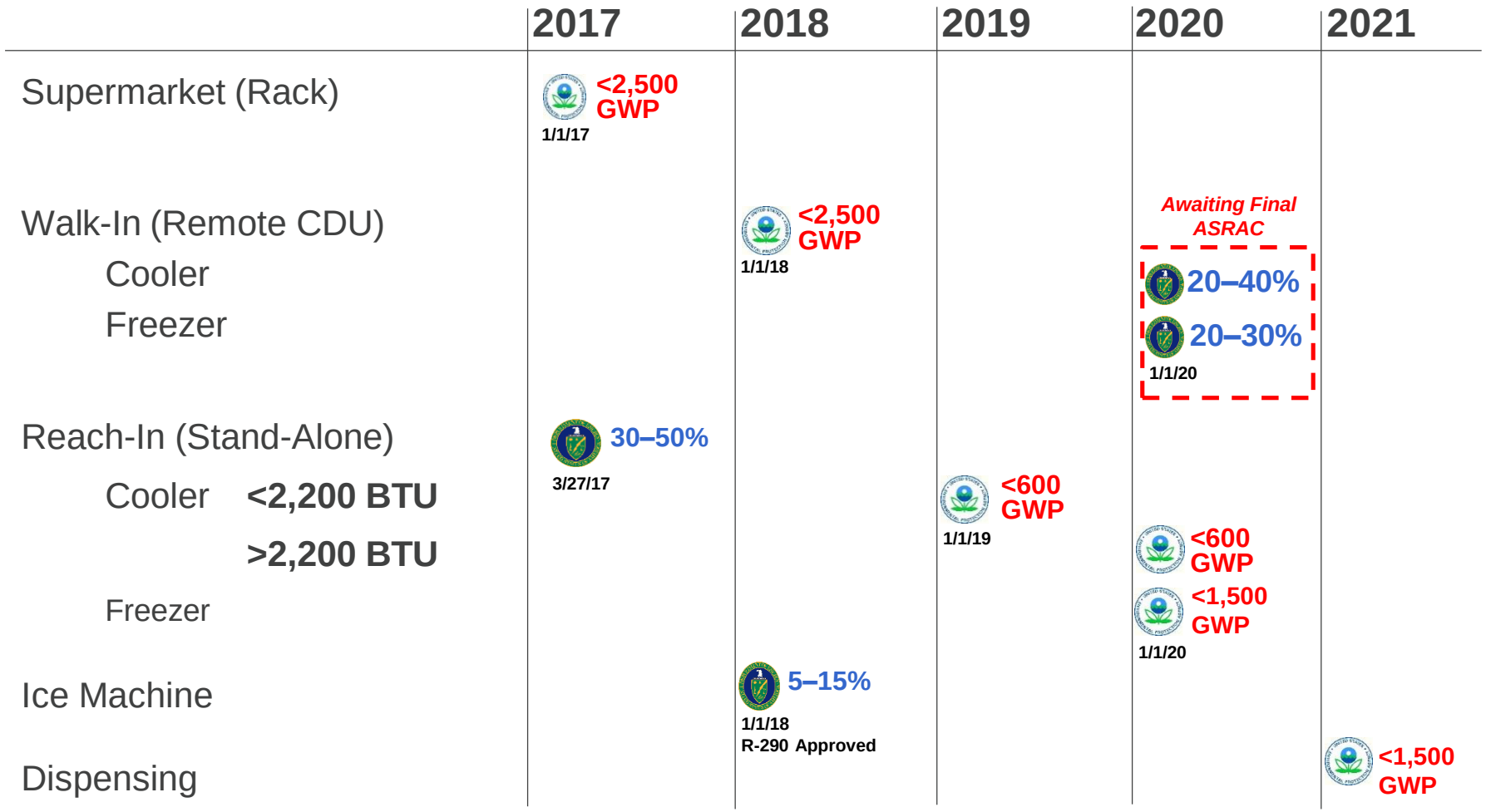
Compliance Will Not Be Easy

EPA Refrig.

DOE Energy

Energy
Environment
Equipment
$ Economics



Opportunity to Comply With One Design Cycle Change

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

APPLIANCE & EQUIPMENT STANDARDS PROGRAM | CCMS

Current Number of Models Listed

CRE	37,616
ACIM	797
WICF	1,673

- Google “DOE CCMS” or …
  - https://www.regulations.doe.gov/ccms
- DOE enforcement mechanism
  - Fines have been imposed
- Annual certification required by submitting new CCMS and supplemental testing forms each year

Source: Department of Energy

Emerson Climate Technologies Product Line Efficiency Approach & Methodology

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Reasons For This Condensing Unit Product Line Efficiency Improvement

Department Of Energy Regulations

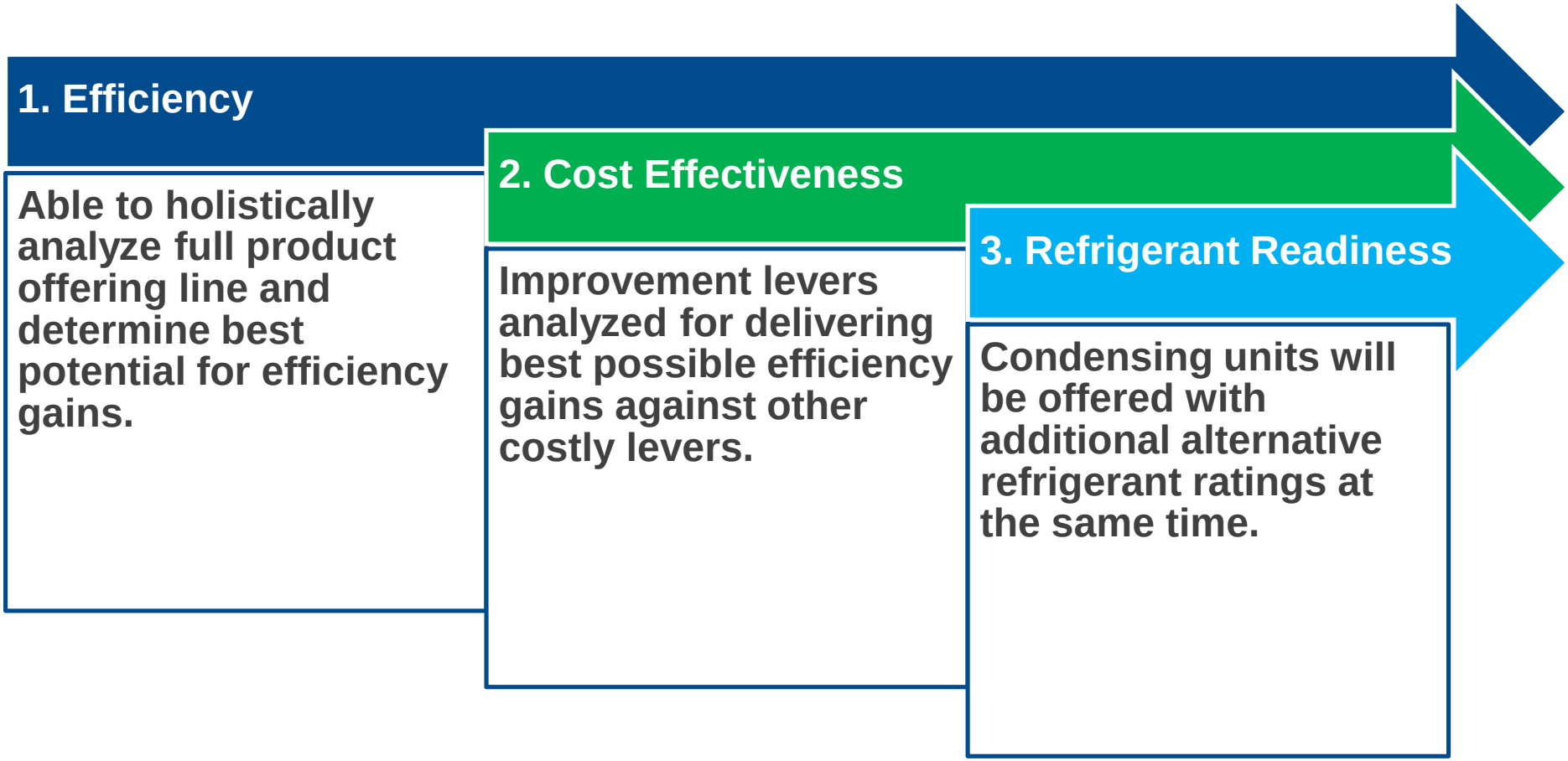
- Commercial Refrigeration Equipment require 30%-50% energy improvements
- March 2017 impact date
- Condensing units account for ~75% energy consumption with ~65% duty cycle of a system

Environmental Protection Agency Regulations

- Standalone refrigeration equipment will no longer be able to use 134a/404A beginning in 2019 & 2020 respectively by temperature class
- 448A/449A for LT & 450A/513A for LT/MT are acceptable non-flammable alternatives for use

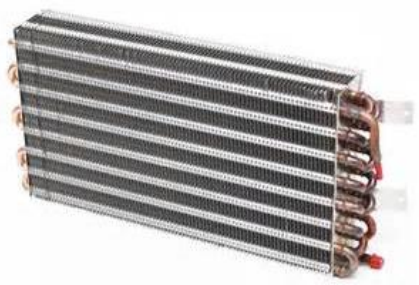
Emerson Climate Technologies offering a product line that can address both DOE and EPA regulations at the same time creating only one cost effective open design cycle.

Product Line Improvement Approach



Lowering Temperature Difference Between Ambient & Condensing Temperature Is Primary Focus In Order To Reduce Compressor Run Time

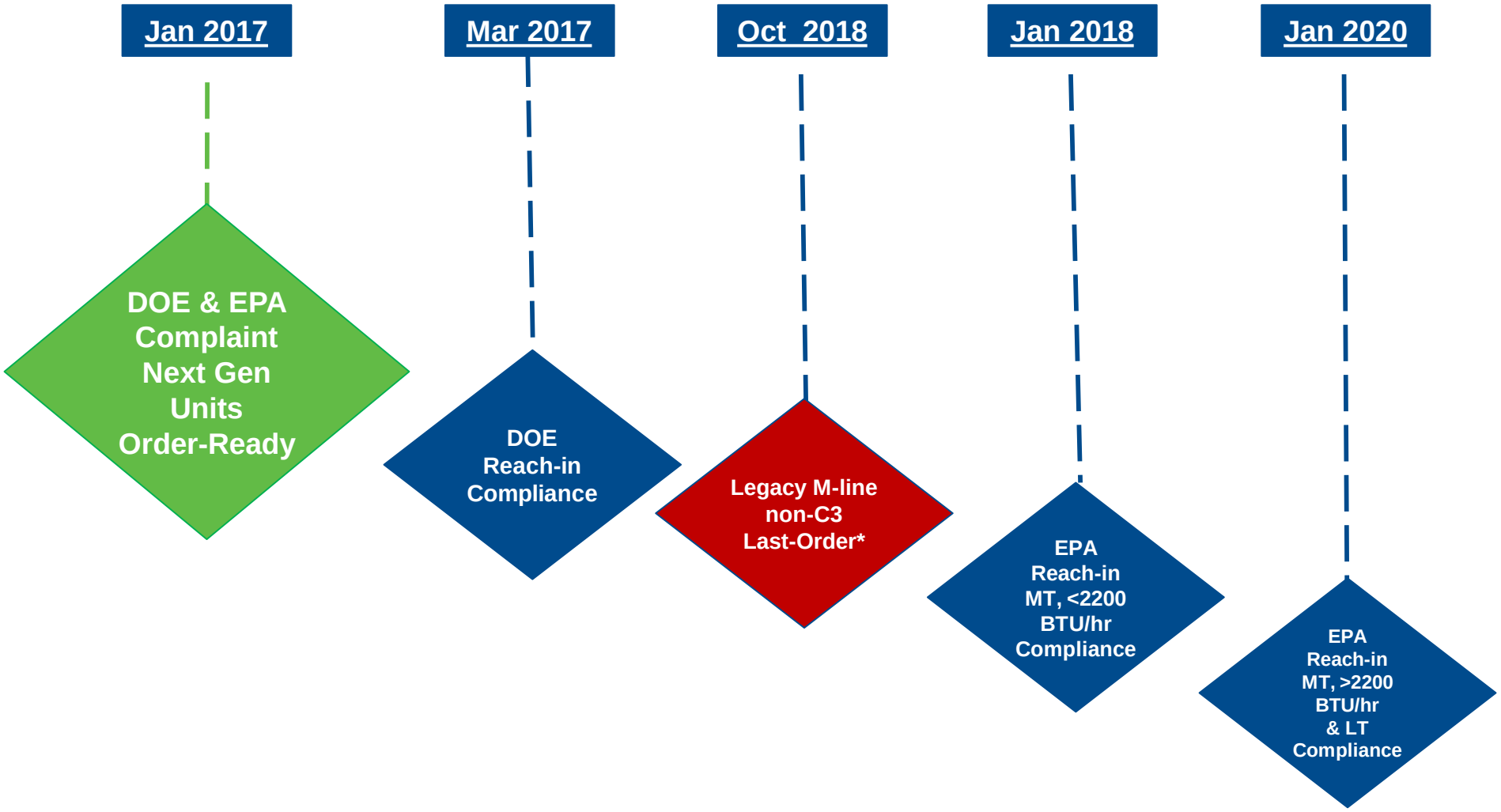
Product Line Improvement Levers

Compressor	Refrigerant	Fan	Coil
			
IAA → *CAA C3E → C4E A/R → *Next Gen A/R	404A → 448A/449A 134A → 450A/513A R-290	Shaded Pole → ECM**	Rifled Tubing Additional Rows
+5-20%+	Up to +10% A1 Up To +18% A3	+5%	+% varies by size

*Where Applicable
**Optional

Larger chassis sizes are available if additional efficiency gains are needed.

DOE Units Optimization – Hermetic Timeline



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Next Gen Unit Nomenclature & Design Layouts

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DOE Next Gen Units: M6 & M7 Standard Options

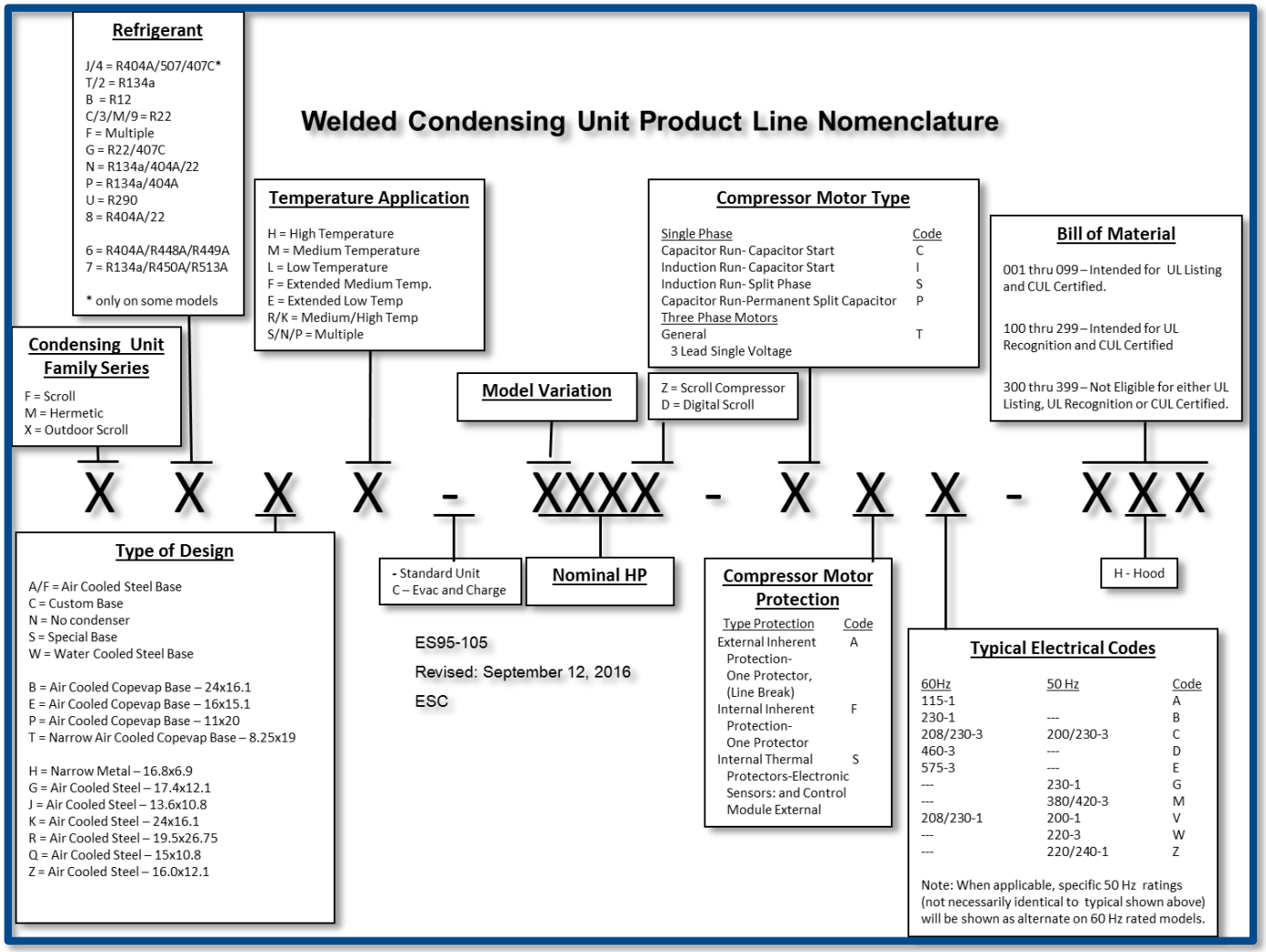
Options	Suggested OEM BOM's						Suggested Wholesaler BOM's	
	020	028*	212	072	078*	272	177 (like 103 w. FD/SG)	179 (like 111 w. FD)
UL	Listed	Listed	Recognized	Listed	Listed	Recognized	**Recognized**	**Recognized**
Filter Dryer				yes	yes		yes	yes
Sight Glass				yes	yes		yes	
Fan Guard	yes	yes		yes	yes		yes	yes
Suction Valve	yes	yes		yes	yes		yes	yes
Receiver	yes	**yes**		yes	**yes**		yes	
High Pressure/EUC	yes			yes				
Conduit	yes	yes		yes	yes			
End Cover	yes	yes		yes	yes			
Power Cord							yes	yes

* Units with a compressor RLA under 6A do not require pressure controls for UL listing. xx8 will identify units under 6A that are listed, but they do not have pressure controls.

** 3xx is no UL, 50 HZ BOM.

Per chassis applicable standard options will be order-Ready in Jan 2017. Customers' specials will be released per requests as IPPR.

DOE Next Gen Units Nomenclature: M6 & M7



October 2018
Last Order for All Existing M2 and M4 Models

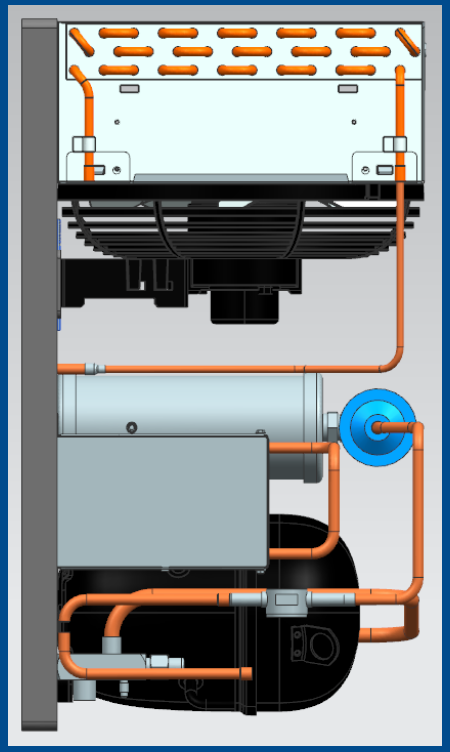
DOE Next Gen Units Nomenclature: M6 & M7

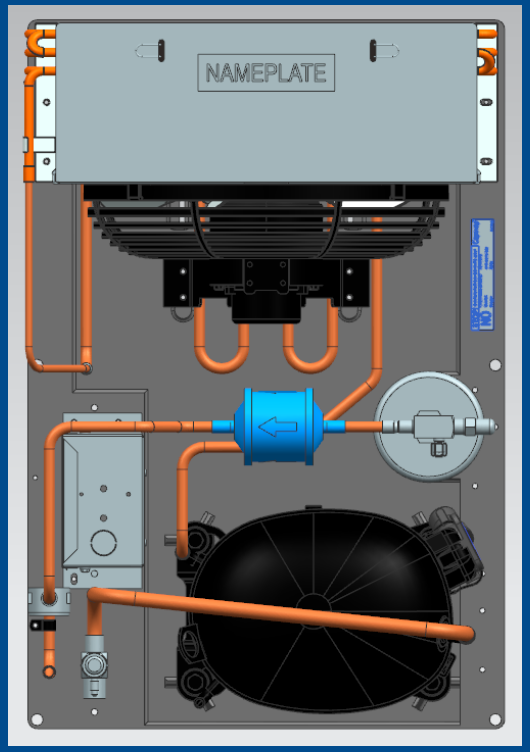
Family	Refrigerant	Type of Design (Chassis: L x W)	Temperature Application	_	Model Variation
F = Scroll units	F = Multiple	A/F = Air Cooled Steel Base	L = Low	C = Evac & Charge	0 = Base Efficient model
M = Hermetic units	U = R290	C = Custom Base	M = Medium		A = Base Eff. Revision 1
X= Outdoor Scroll	6 = 404A/448A/449A	N = No condenser	H = High		B = Base Eff. Revision 2
	7 = 134A/450A/513A	S = Special Base	P = Multiple		D = Base Eff. Revision 3
		W = Water Cooled Steel Base			E = Base Eff. with EC Motor
		B = Air Cooled Copevap Base – 24x16.1			H = High Efficient model
		E = Air Cooled Copevap Base – 16x15.1			P = High Eff. Revision 1
		P = Air Cooled Copevap Base – 19.9x11.0			Q = High Eff. Revision 2
		T = Narrow Air Cooled Copevap Base – 19.0x8.3			S = High Eff. Revision 3
		H = Narrow Metal Steel – 16.8x6.9			U = High Eff. w. EC motor
		G = Air Cooled Steel – 17.4x12.1			
		J = Air Cooled Steel – 13.6x10.8			
		K = Air Cooled Steel – 24x16.1			
		R = Air Cooled Steel – 19.5x26.75			
		Q = Air Cooled Steel – 15x10.8			
		Z = Air Cooled Steel – 16.0x12.1			

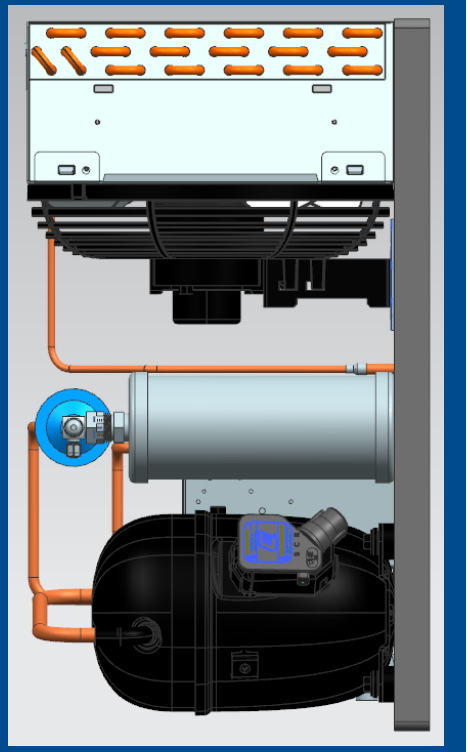
October 2018
Last Order for All Existing M2 and M4 Models

Design B - Cope-Vap Base New Layout

Footprint L x W x H	Customer Connections
24.0 x 16.4 x 13.64 Cope-Vap	5/8” or ½” ID Suction 3/8” ID Liquid







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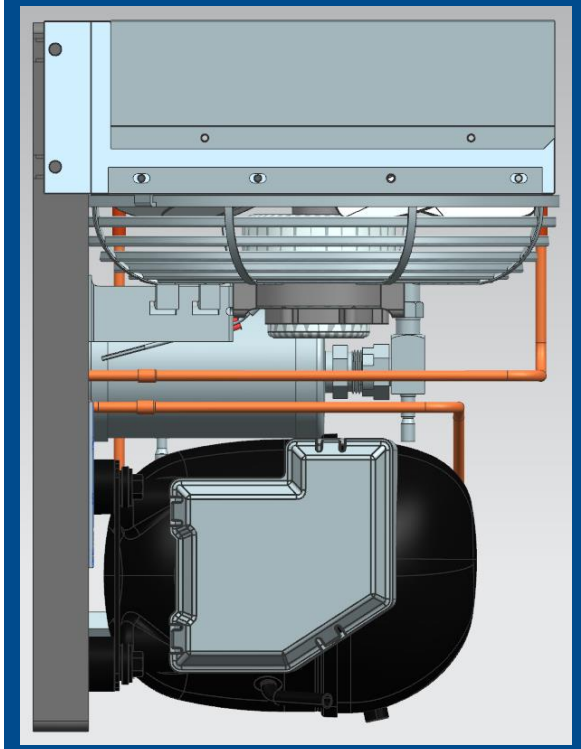
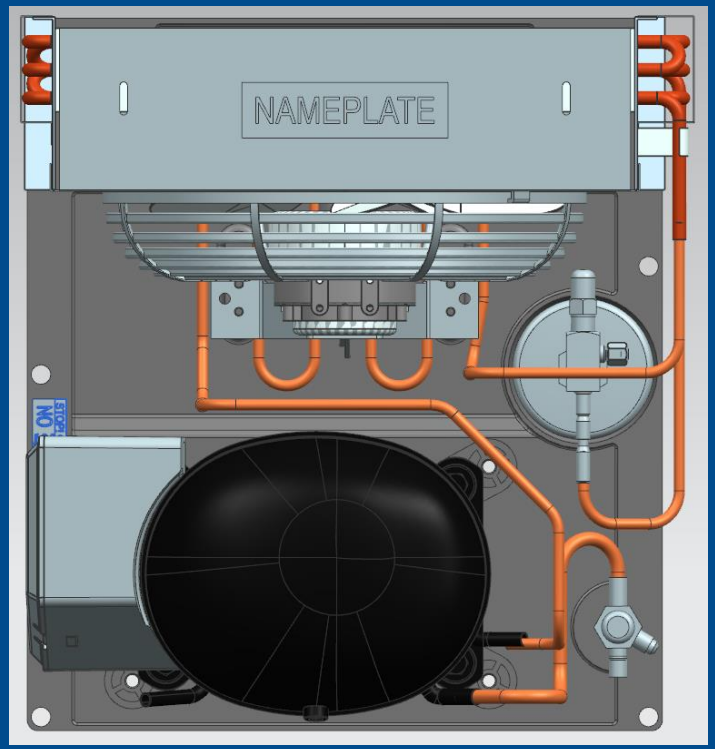
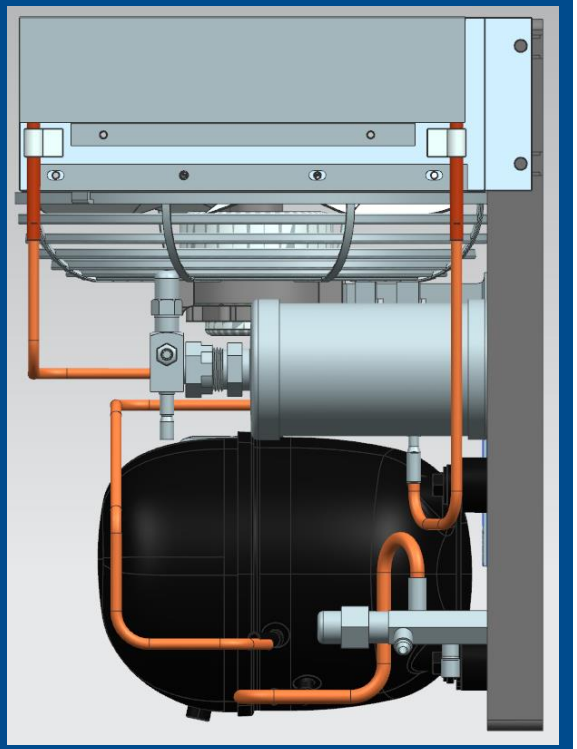
Design E - Cope-Vap Base New Layout

Next Gen Model	Condenser	Footprint L x W x H	Customer Connections
Base Efficiency Model e.g. M6EL-**0**30-IAA-028	3 Row Conventional Condenser	16.0 x 14.25 x 10.5 Cope-Vap	3/8” ID Suction ¼” ID Liquid
High Efficiency Model e.g. M6EL-**H**062-CAA-212	5 Row Rifled Condenser		







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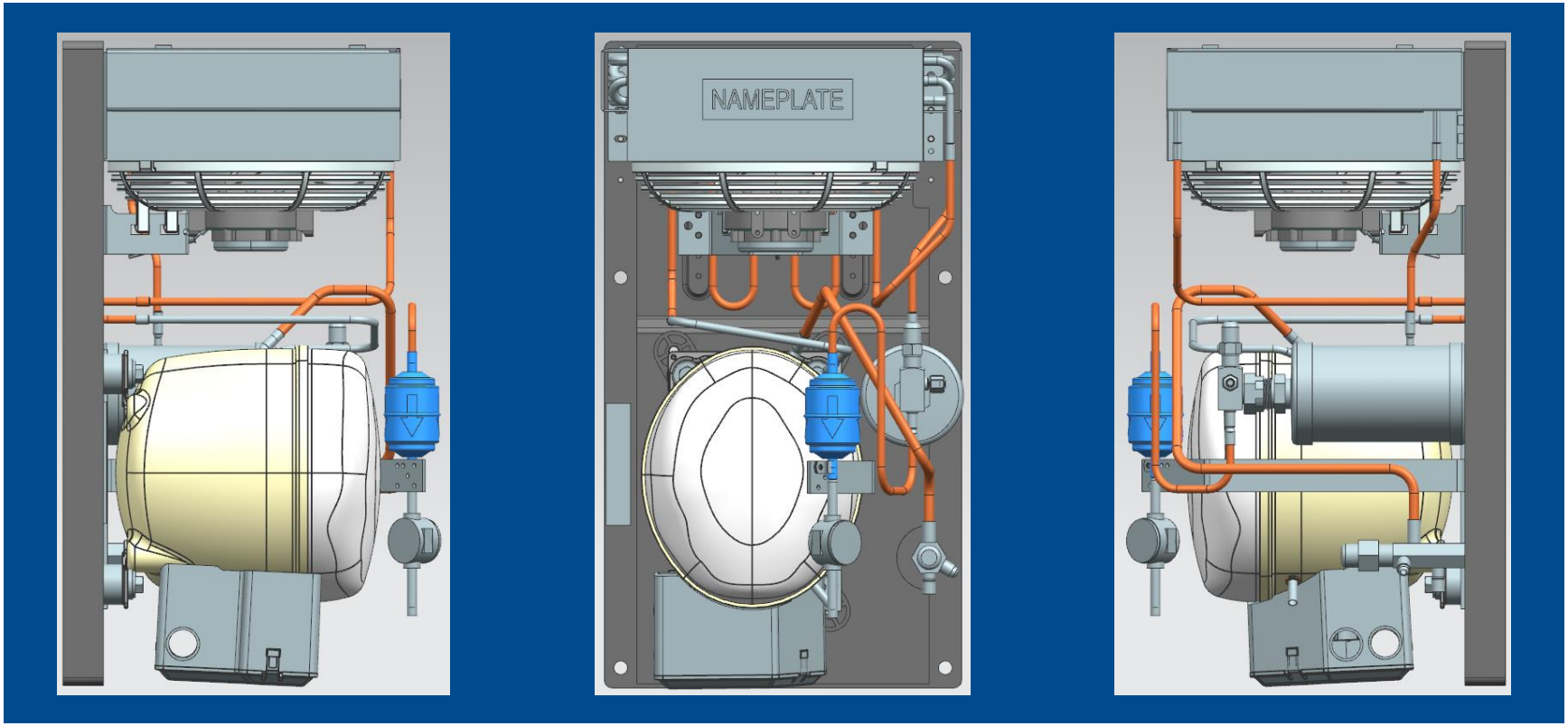
Design P - Cope-Vap Base New Layout

Footprint L x W x H
19.9 x 11.2 x 11.2 Cope-Vap



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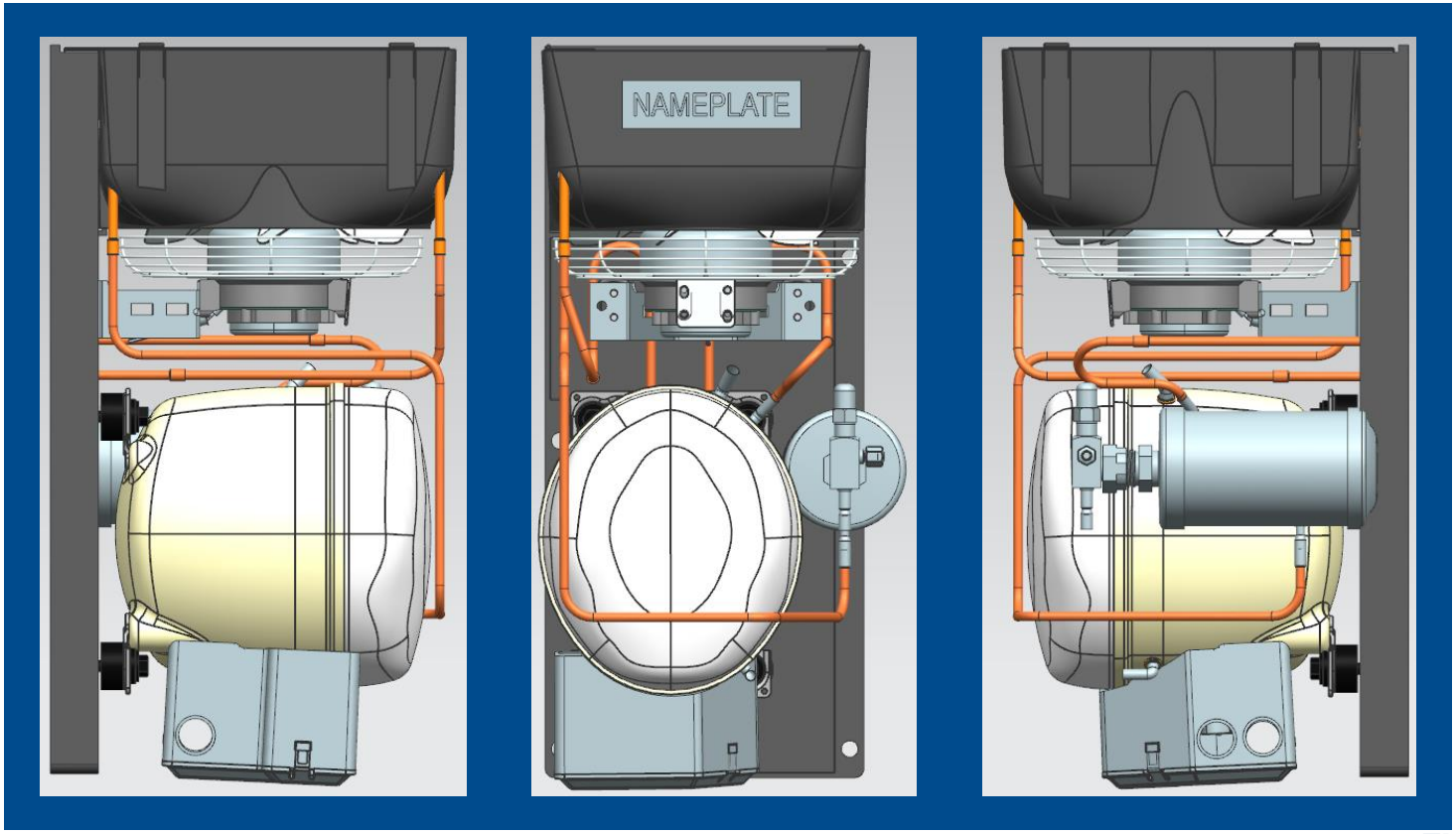
Design T - Cope-Vap Base New Layout

Footprint L x W x H
19.3 x 9.4 x 10.5 Cope-Vap



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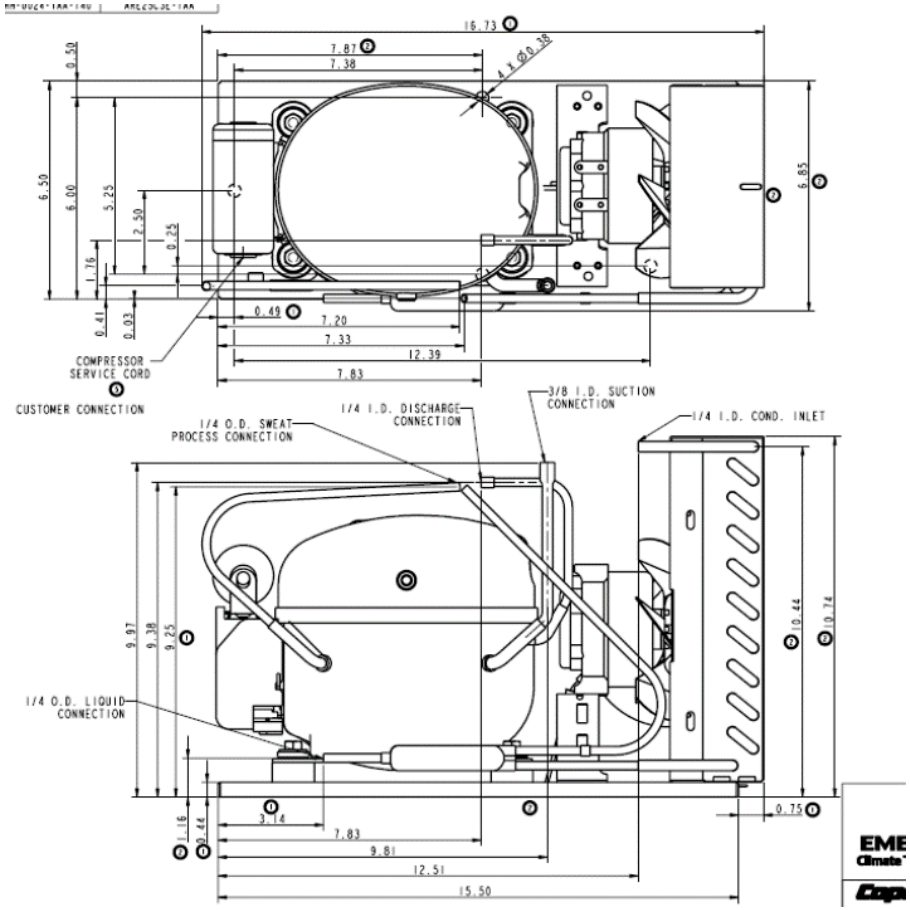
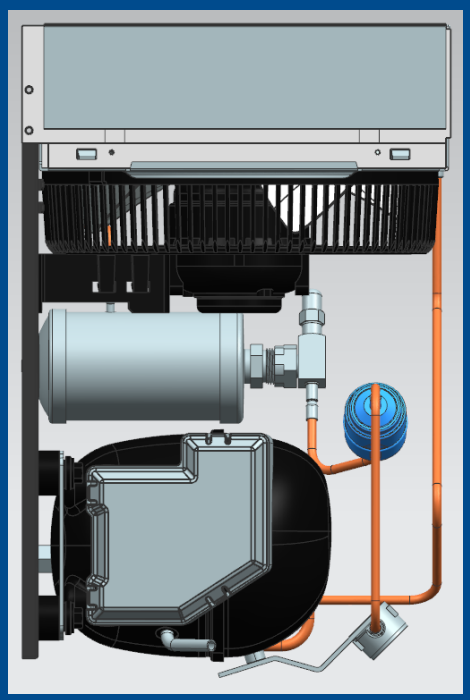
Design H - Steel Base New Layout

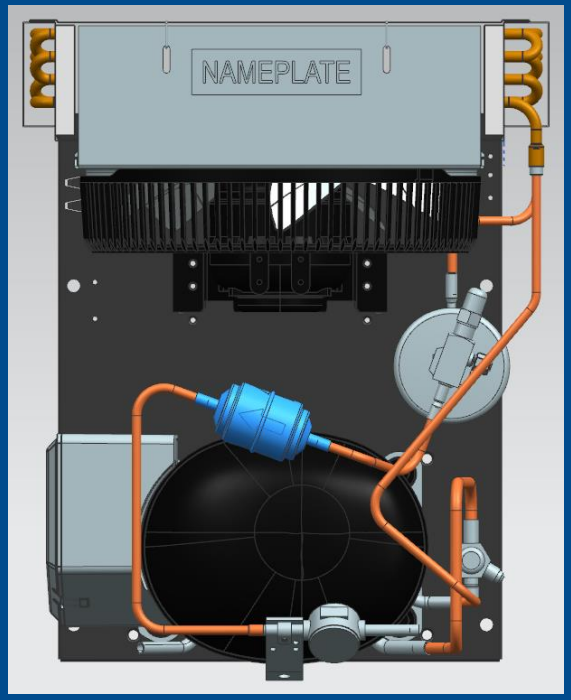
Footprint L x W x H
16.8 x 6.9 x 10.8 Steel

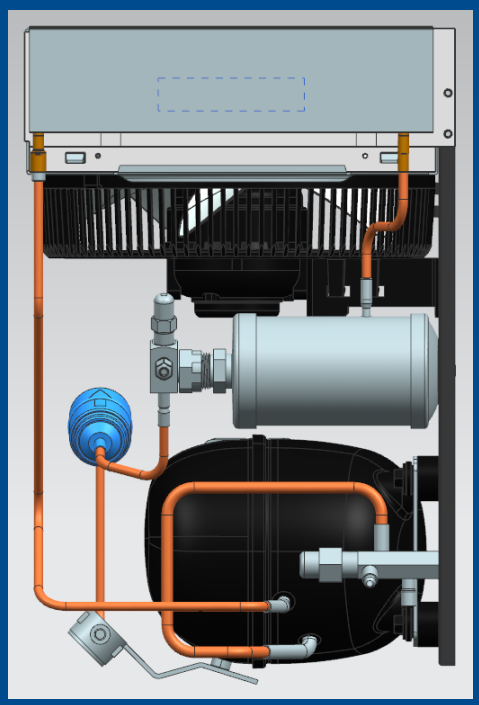


Design G - Steel Base New Layout

Footprint L x W x H
17.4 x 12.1 x 11.8 Steel

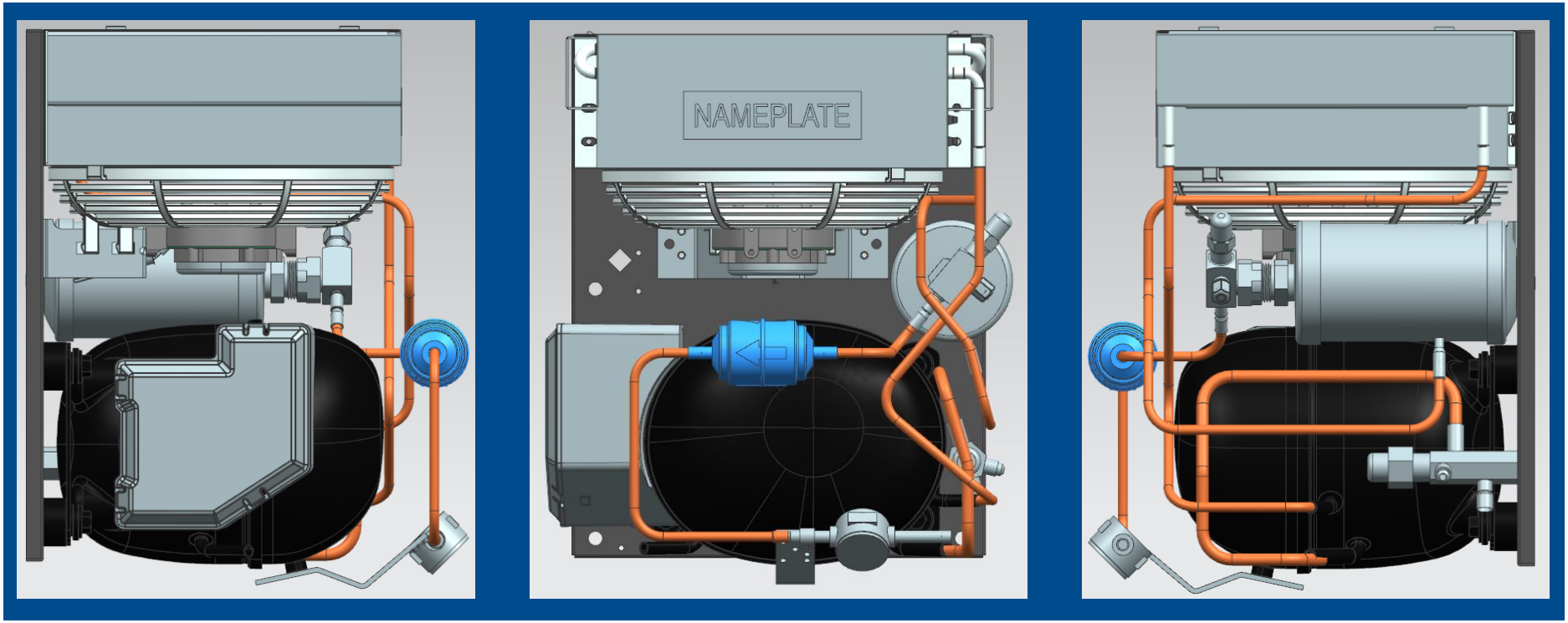






Design J - Steel Base New Layout

Footprint L x W x H
14.1 x 12.2 x 11.8 Steel



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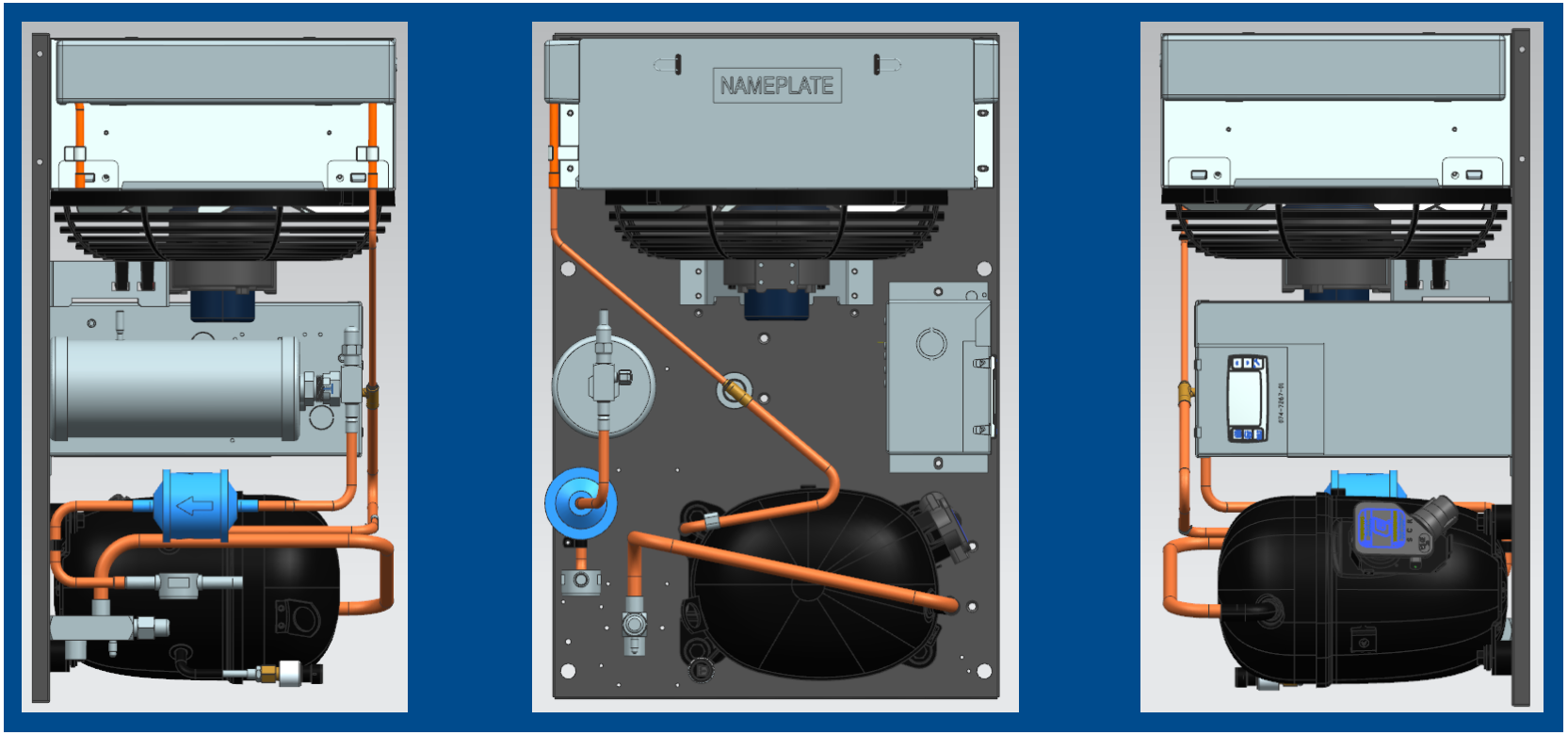
Design K - Steel Base New Layout

Footprint L x W x H	Customer Connections
24.0 x 16.4 x 13.1 Steel	5/8” or ½” ID Suction 3/8” ID Liquid



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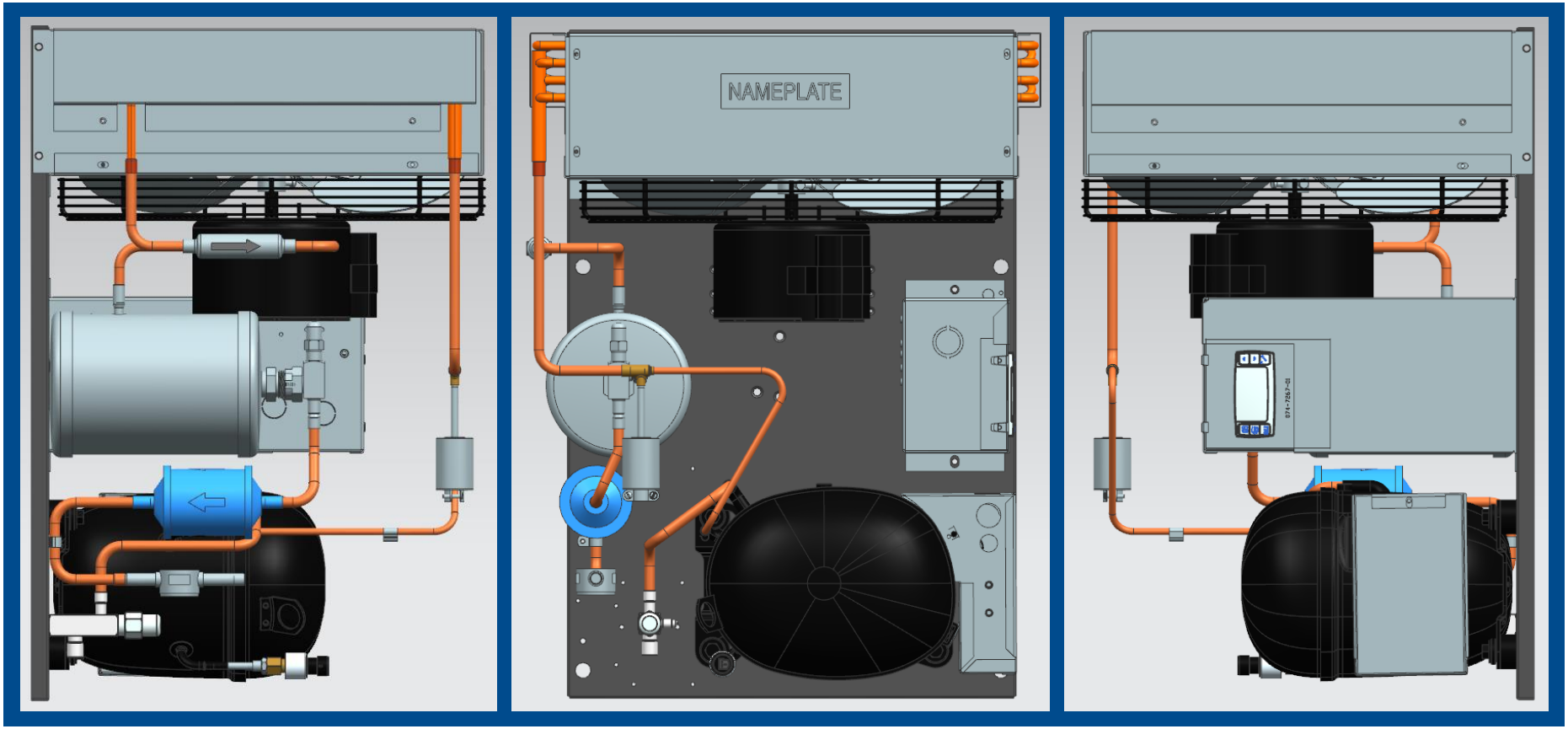
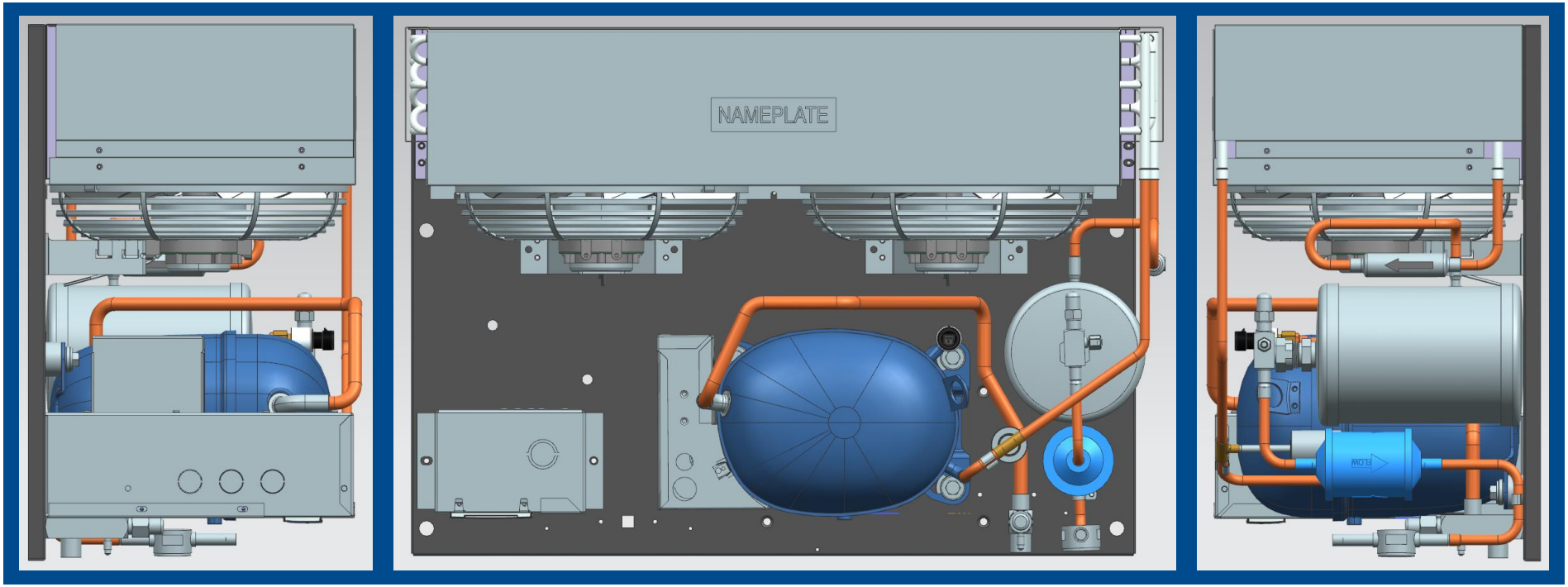
Design K - Steel Base New Layout

Footprint L x W x H	Customer Connections
24.0 x 18.3 x 16.2 Steel	5/8” or ½” ID Suction 3/8” ID Liquid



Design R - Steel Base New Layout

Footprint L x W x H	Customer Connections
19.5 x 27.9 x 11.9 Steel	5/8” or ½” ID Suction 3/8” ID Liquid



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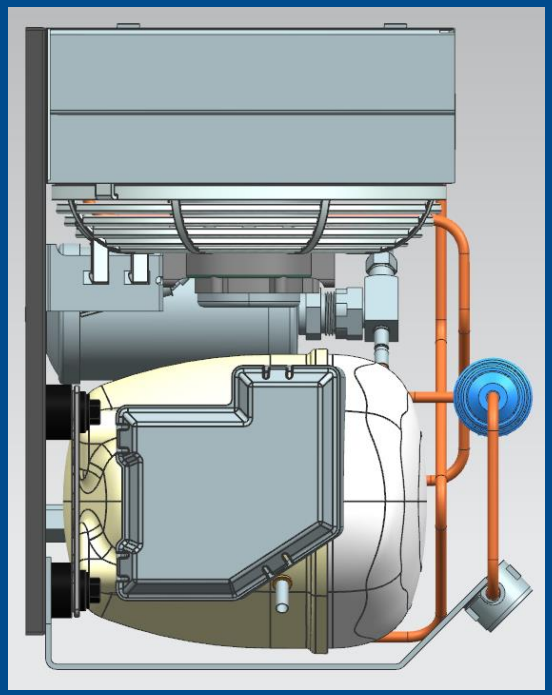
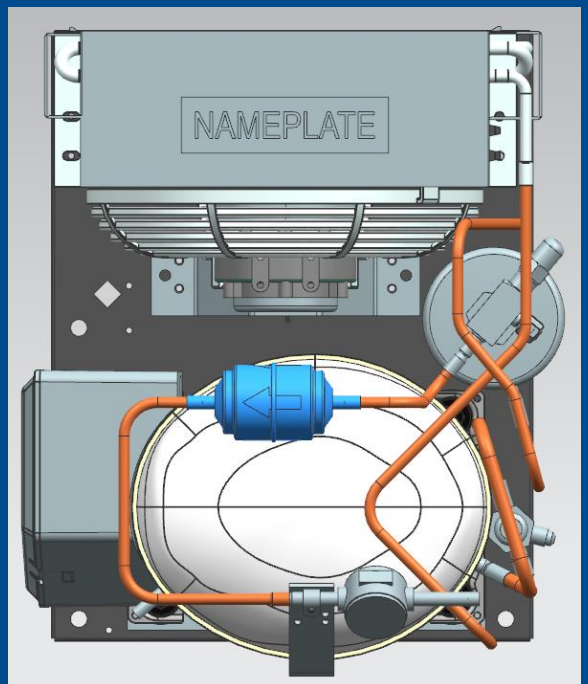
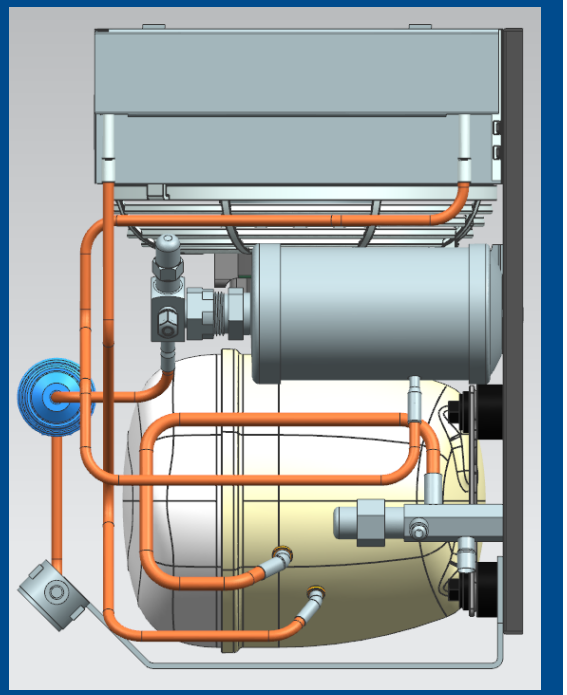
Design Q - Steel Base New Layout

Footprint L x W x H
15.7 x 12.2 x 11.7 Steel







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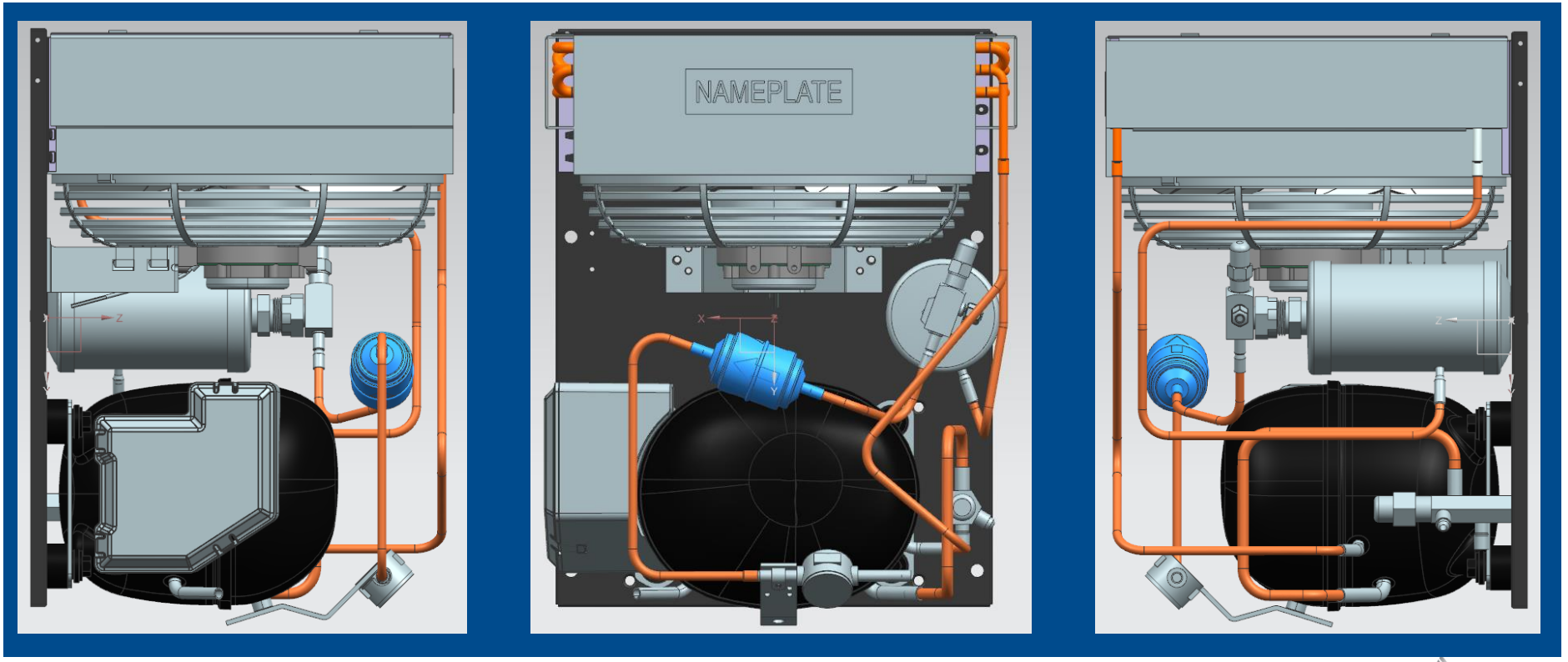
Design Z - Steel Base New Layout

Footprint L x W x H
16.3 x 12.1 x 11.8 Steel



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