



Heating Coils

Why Leaky Coils Are a Losing Proposition

Leaky coils can be the beginning of the end for efficient heat transfer. Although coils may fail for a variety of reasons, mechanical failure and corrosion are the culprits in the majority of cases. When coils corrode, unwanted moisture and contaminants may foul the air stream or exhaust gases. And a steam leak from a badly corroded coil simply blows precious energy off into the atmosphere.

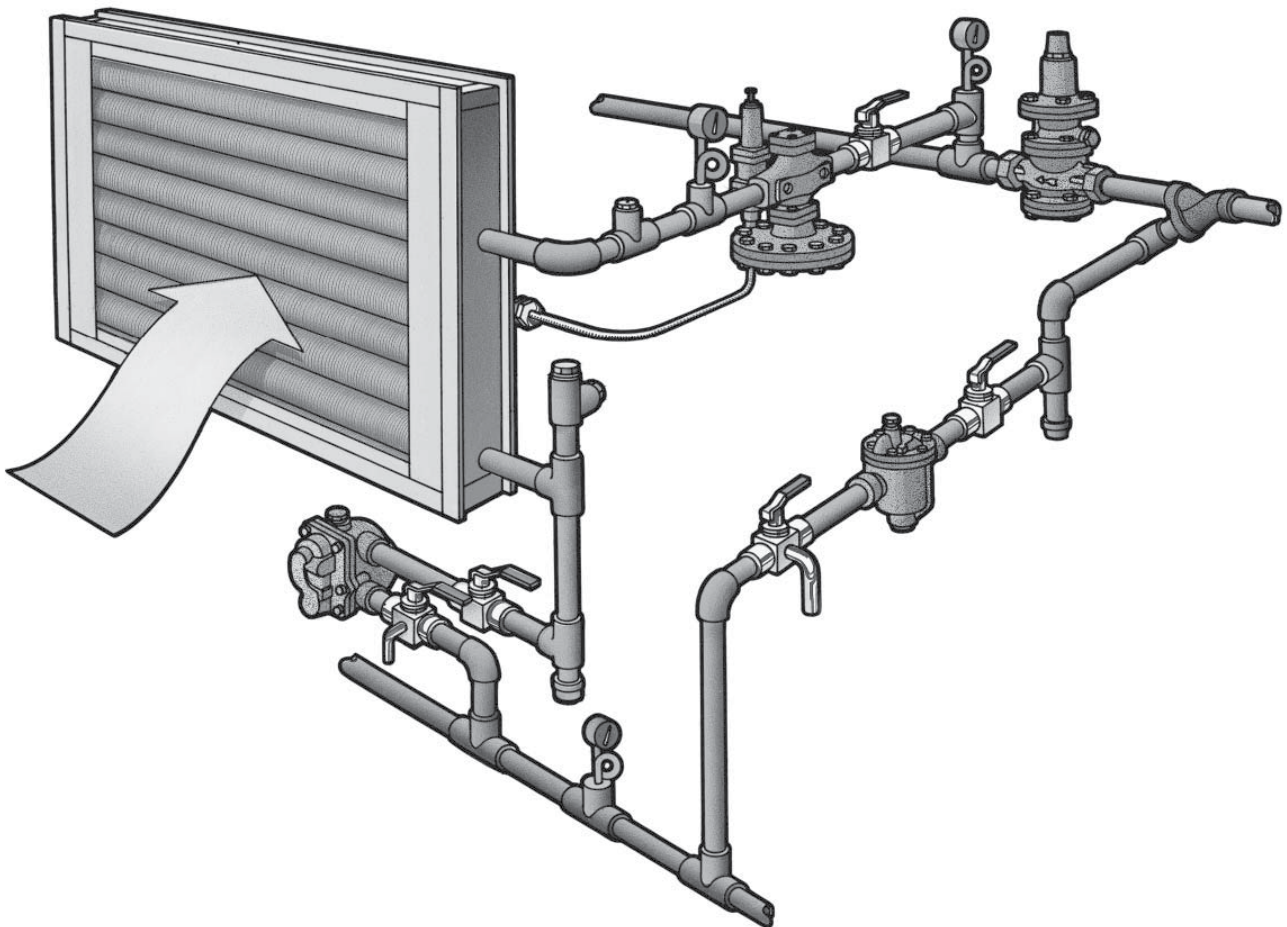
External corrosion. Contaminants in the airstream cause external corrosion. Dirt buildup intensifies corrosive action by trapping contaminants in concentrated pockets. And it's accelerated when dirt becomes strong airborne mist. Factors such as inappropriate fin pitch, fabricating techniques and material selection may also fuel external corrosion.

Internal corrosion. Retention of contaminated condensate or inadequate venting of non-condensable gases are major causes of internal corrosion. When CO₂ gas dissolves in

condensate that has cooled below steam temperature, it forms highly corrosive carbonic acid. Likewise, oxygen left to stagnate in the system fosters corrosive action by pitting iron and steel surfaces. Joining pipes/tubes in headers of dissimilar materials may spawn galvanic action. Internal stresses due to improper welding may also hasten corrosion damage.

Armstrong to the Rescue

Armstrong's help in coil selection and design is one of the best defenses against external corrosion. We offer a wide selection of fin pitches to help combat dirt buildup. What's more, sturdy fins lend extra strength to withstand high-pressure cleaning without damage or distortion. As a defense against non-environmental factors, Armstrong fabricates coils in a full range of metals and alloys. You may also specify special coatings to increase external corrosion resistance.



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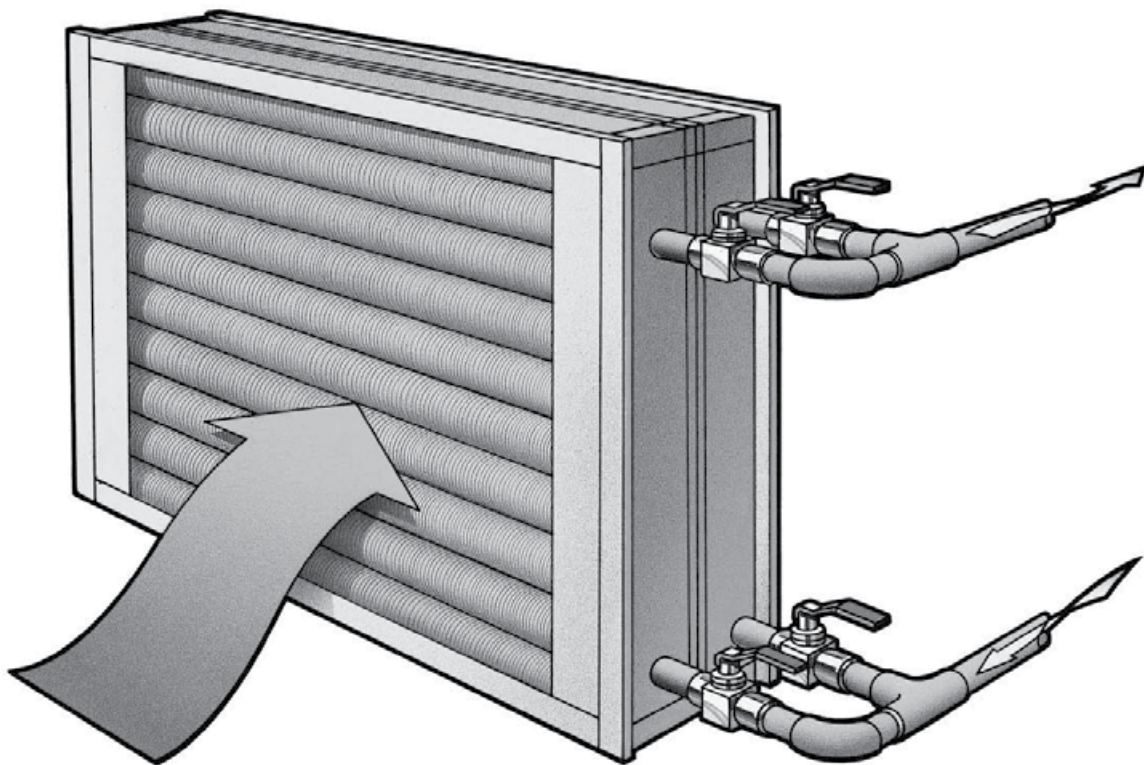
Proper trapping and venting—a specialty of your Armstrong Representative—is where defense against internal corrosion begins. Armstrong reps are steam specialists with more than 75 years of experience in properly sizing, locating and piping steam traps, strainers, vents and related equipment. That's why only Armstrong gives you quality steam coils—plus the installation and trapping help you need to make them work in your total system.

A System to Make Yours More Efficient

Today, the Armstrong “system” merges coil-building experience, practical knowledge and technical know-how from years of trapping coil installations. The result: coils that survive the rigors of high pressures, high temperatures and corrosive conditions.

For example, Armstrong fabricates standard steel heating coils from 1" OD 12 ga ERW Tube (.109" wall) helically wound with 0.024" thick steel fins at varying fin pitches. Each coil is tested during construction, and the completed unit is again tested hydrostatically to not less than 1.3 times the design pressure with a standard testing pressure at 450 psig for steel or stainless steel cores.

It's this simple: It takes one system to improve another. Exactly how the Armstrong system of product and service carefully matches coils to your specs and applications is the subject of the following pages.



Material Selection for Tubes, Headers and Connections

The choice of tube material depends upon several important factors:

- The corrosive quality of the steam or liquid medium
- The ability to pipe, trap and vent steam coils effectively
- The size and service requirements of the installation
- The external corrosion to which the coils are likely to be subjected

Generally speaking, the heat transfer characteristics of the tube material are of little consequence. The table on the next page illustrates the relative effect of tube materials on overall heat transfer. Because the fin area constitutes the vast majority of the heat transfer surface, it is the most important factor determining heat transfer effectiveness. Therefore, the choice of tube materials should be based on service requirements, not heat transfer efficiency.

Internal corrosion. The base material found in the 6000 Series coils is steel. The minimum wall thickness is .109" for steam coils and liquid coils, which affords both strength and corrosion resistance. All Armstrong coils are of monometallic design, which means that all wetted parts are made of the same materials. This precludes the likelihood of galvanic corrosion often experienced in coils made of dissimilar materials. For most applications, steel will provide very satisfactory service. In order to do this, however, steam coils must be carefully piped, trapped and vented to ensure good condensate and non-condensable gas evacuation.



The cross section of the coil on the right shows how internal corrosion caused by improper piping, trapping and venting may destroy coils from the inside out.

There are many cases where the steam cannot be conditioned enough to be non-corrosive or it is not possible to pipe, trap and vent the coils properly. For those areas, Armstrong recommends stainless steel wetted parts. Choosing which of these is most appropriate depends on the degree and type of problem as well as the steam pressure involved.

External corrosion. In the case of external corrosion, factors concerning the corrosiveness of the airstream enter into the decision. The choice of steel or stainless steel for the wetted parts depends on the compatibility of those materials with the contaminants in the airstream. In addition to the base materials available, Armstrong also offers hot dipped galvanizing, epoxy dip or baked phenolic coatings. These are frequently used when only external corrosion is a consideration.

Service requirements. These may be as important as the above considerations. Coil failures manifest themselves in many forms, but the most prevalent is failure of the tube-to-header joints. This failure occurs as a result of coil design defects, insufficient material at the tube-to-header joints or because of the method of connecting the tubes to the headers.

Armstrong 6000 Series coils are designed to accommodate the service requirements of the particular installation. They are built with enough material at the tube-to-header joints to make them strong. When differential expansion between tubes in steam coils is likely to over-stress the joints, centrifuge type coils are recommended. Finally, Armstrong coils are always of welded construction, providing the best method of connecting the two parts together.



Computer-controlled equipment like this simplifies the process of drilling coil headers.



Tube Materials

The best combination of coil materials is the one that delivers maximum heat transfer **and** service life. Tubes, regardless of material, contribute little to heat transfer in extended-surface coils. It is the **fins**, fully exposed to the airstream, that provide the greatest contribution to heat transfer. Therefore, choose tube material on the basis of application.

Relative Heat Transfer Capacities of Identical Coils Using Different Tube Materials	
Tube Material	Relative HT Capacity
Copper	1.00
Aluminum	1.00
Steel	.98
Stainless Steel	.95

Material Selection for Fins

The heat transfer coil is essentially a tube on which fins are spirally wound or similarly attached. The fins produce an extended surface to improve heat transfer to or from air or other gases passing over the fins. The effective heat transfer of a coil is based on fin pitch (number of fins per inch), fin height, fin material and method of attachment.

Copper fins offer the best heat transfer, but aluminum fins provide the best overall value. Compared to aluminum fins, steel fins reduce heat transfer. Compared to aluminum and steel, stainless steel fins reduce heat transfer significantly. Fins may be of aluminum, copper, steel, or stainless steel, depending on contaminants, operating conditions and economic considerations.

The selection of fin materials should be based upon several considerations:

- The heat transfer characteristic desired
- The compatibility of the material with the air stream
- The amount and type of particulate matter in the air stream
- The frequency and aggressiveness of coil cleaning

The table below illustrates the heat transfer effectiveness of various fin materials with Armstrong coils. Note that these relative heat transfer capacities are for a specific set of conditions. The factors will vary with different conditions.

The fin/tube combinations available are listed on page 321.

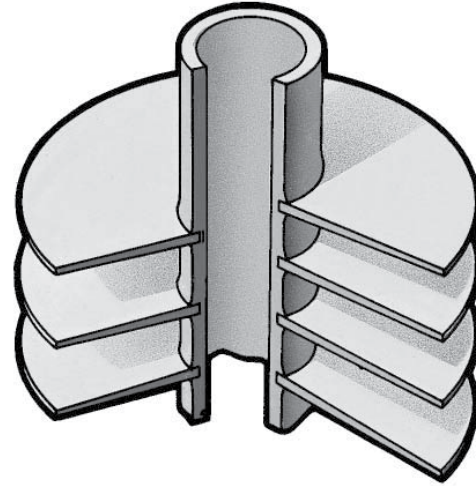
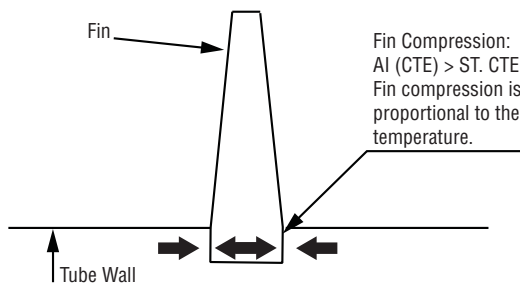
Relative Heat Transfer Capacities of Armstrong Coils With Tubes and Fins of Various Materials*		
Tube Material	Fin Material	Relative HT Capacity
Steel	Copper yfin	Ke 1.05
Steel	Aluminum yfin	Ke 1.00
Stainless Steel	Aluminum Keyfin	.94
Steel	Steel L Fin	.92
Stainless Steel	Stainless Steel L Fin	.58

*At 800 ft/min velocity, 7 fins/inch and 300°F steam temperature. Will vary at other conditions.

Fin Types

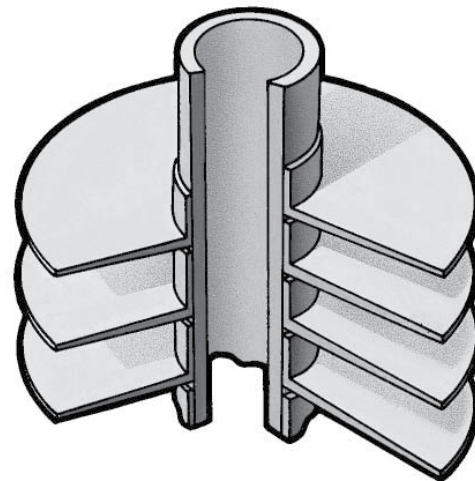
Keyfin

The keyfin is the standard design for Armstrong's most popular coils. Keyfin coils are manufactured by forming a helical groove in the tube surface, winding the fin into the groove and peening the displaced metal from the groove against the fin. This means a tight fit between the fin and the tube, providing for efficient operation over wide temperature ranges. Keyfin is the superior design for dissimilar fin and tube materials.



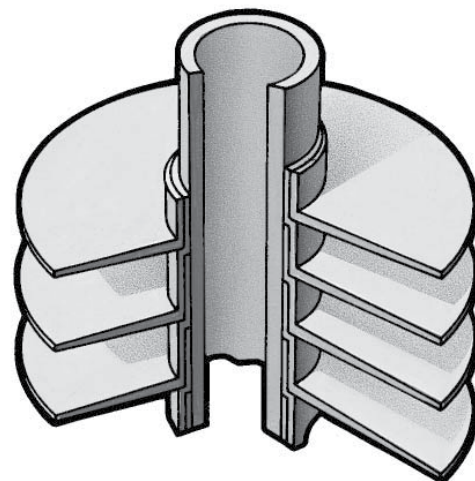
L Fin

The L fin has a "foot" at its base and is tension wound on knurled tube material. The L-shaped base provides a large contact area between the tube and the fin, ensuring effective, long-lasting heat transfer. The L fin is recommended when tubes and fins are of the same material.



Overlap L Fin

The overlap L fin is simply an L fin with an extended base. Each fin overlaps the foot of the previous fin, completely covering the tube surface. The overlap technique makes it possible to create a completely aluminumized coil for applications where exposed steel would be vulnerable to corrosion.



Why Settle for What's "Available" When You Can Specify Exactly What You Need?

Armstrong manufactures heavy-duty industrial coils in a wide range of sizes and materials to meet virtually any application demand. Dimensionally duplicated to fit your

exact requirements, Armstrong coils are what you need. Whether it's off the shelf or off the wall. Other materials will be considered upon request.

Construction Features		
Tubes/Pipes		
Carbon Steel Tubes	Standard	12 ga A-214 ERW
	Optional	10 ga A-214 ERW
		12 ga A-179 seamless
		10 ga A-179 seamless
Carbon Steel Pipes	Optional	Sch 80 seamless; A-106 Gr 'B'
Stainless Steel Tubes	Standard	14 ga (1" OD) 12 ga (1-1/2" OD) A-249 type 304L
	Optional	14 ga (1" OD) 12 ga (1-1/2" OD) A-249 type 316L
Fins		
Steel	Standard	0.024" thick on 3/4" NPS pipes
		0.024" thick on 1" OD tubes
		0.036" thick on 1-1/2" OD tubes & 1" NPS & larger pipe
Aluminum	Standard	0.020" thick on all tube sizes
		0.016" thick on 1" OD
	Optional	0.030" heavy keyfin 1" & 1-1/2" OD steel and stainless steel tube
Stainless Steel		0.020" thick type 304 & 316 on all sizes
Copper		0.016" thick on all sizes
Connections		
Steel		Sch 80 (screwed), Sch 40 (flanged)
Stainless Steel		Sch 40 (screwed), Sch 10 (flanged)
Headers		
All coils have headers of the same material as tubing and are of welded construction.		
Casing		
Galvanized Steel	Standard	Minimum 12 ga galvanized for depth 7-1/2" and over
		Minimum 14 ga galvanized for depth under 7-1/2"
Stainless Steel	Optional	14 ga type 304 & 316 for all depths
Aluminum	Optional	12 ga for all depths
Other gauge material available on request. All casings have drilled flanges for duct mounting unless specified otherwise.		
Design Pressure		
Standard design pressure for steel coils is 300 psig @ 650°F, stainless steel coils 300 psig @ 500°F. Hot oil coil: 250 psig @ 750°F. Higher pressure and/or temperature construction is available on request. -20°F MDMT, lower MDMT available on request.		
Testing		
All coils are tested hydrostatically to at least 1.3 times the working pressure with a standard testing pressure at 450 psig on steel & stainless steel steam coils.		
Options		
Steel tube with steel fin coils can be supplied hot dip galvanized. Steel/steel and steel/aluminum coils can be supplied with baked phenolic or epoxy coatings. Coils are available with ASME Section VIII, Division I, "U" stamps or CRN approval.		

Model Number Selection Series 6000 Coils

MODEL NUMBER															
S	H	2	-	A	09	-	Q	08	-	30	x	72	x	6	-

TYPE OF COIL

L = Liquid
S = Standard
C = Centifed
T = Tandem, Opposite-End Conns
P = Tandem, Same-End Conns

PIPE/TUBE/AIRFLOW ORIENTATION

H = Horiz. Tubes/Horiz. Air
V = Vert. Tubes/Horiz. Air
D = Horiz. Tubes/Vert. Down Air
U = Horiz. Tubes/Vert. Up Air

ROWS DEEP IN DIRECTION OF AIRFLOW

FIN TYPE AND METALLURGY

A = Aluminum Keyfin (.020")
B = Aluminum Heavy Keyfin (.030")
D = Aluminum G Fin (.020")
E = Aluminum Overlap L Fin (.020")
F = Copper Keyfin (.016")
G = Steel L Fin (.024") on 3/4" NPS Pipe and 1" OD Tube
H = Steel G Fin (.024")
J = 304 Stainless Steel L Fin (.020")
K = 316 Stainless Steel L Fin (.020")
U = Aluminum Keyfin (0.016")

LIQUID COILS=NUMBER OF PASSES TH & PH TANDEM STEAM COILS= (L) OR (R) HAND OF COIL*

CASING DEPTH (INCHES)

CASING LENGTH (INCHES)

CASING WIDTH (INCHES)

PIPE NOMINAL BORE SIZE OR TUBE OD IN ONE-EIGHTHS OF AN INCH

PIPE/TUBE TYPE AND METALLURGY

N = Sch 40 Seamless Steel Pipe (SA-106 Gr B)
P = Sch 80 Seamless Steel Pipe (A-106 Gr B)
Q = 12 ga Steel Tube (A-214 ERW)
R = 10 ga Steel Tube (A-214 ERW)
S = 12 ga Steel Tube (A-179 SMLS)
T = 10 ga Steel Tube (A-179 SMLS)
U = Sch 10 304L SS Pipe (A-312)
V = Sch 10 316L SS Pipe (CA-312)
W= 14 ga 304L SS Tube (A-249)
X = 12 ga 304L SS Tube (A-249)
Y = 14 ga 316L SS Tube (A-249)
Z = 12 ga 316L SS Tube (A-249)

FINS PER INCH (FPI)

SPECIFY:

Number, Size and Type of Connections

Also call out non-standard items such as:

- Header Inside or Outside of Casing
- Special Casing Flange Width and Drilling
- Airtight Casing
- Mounting Plate (removable type)
- Coatings, etc.
- Number of Inlets
- Connection Location
- Fluid Circuiting (for Liquid Coil)

*Hand of coil is determined by the position of either the condensate connection or the leaving liquid connection when facing the coil with the airflow to your back.

Longer Life in the Harshest Environments

When it comes to long life under tough industrial conditions, Armstrong is all you need to know about unit heaters. Even in the most severe environments, where coil leaks and corrosion are costly problems, Armstrong coils maintain high efficiency and output.

Armstrong: Why and How

The ability to maintain heat transfer efficiency and resist corrosion—both internally and externally—is why Armstrong unit heaters are uniquely dependable. How we construct them is your assurance of lasting performance, even in severe operating environments.

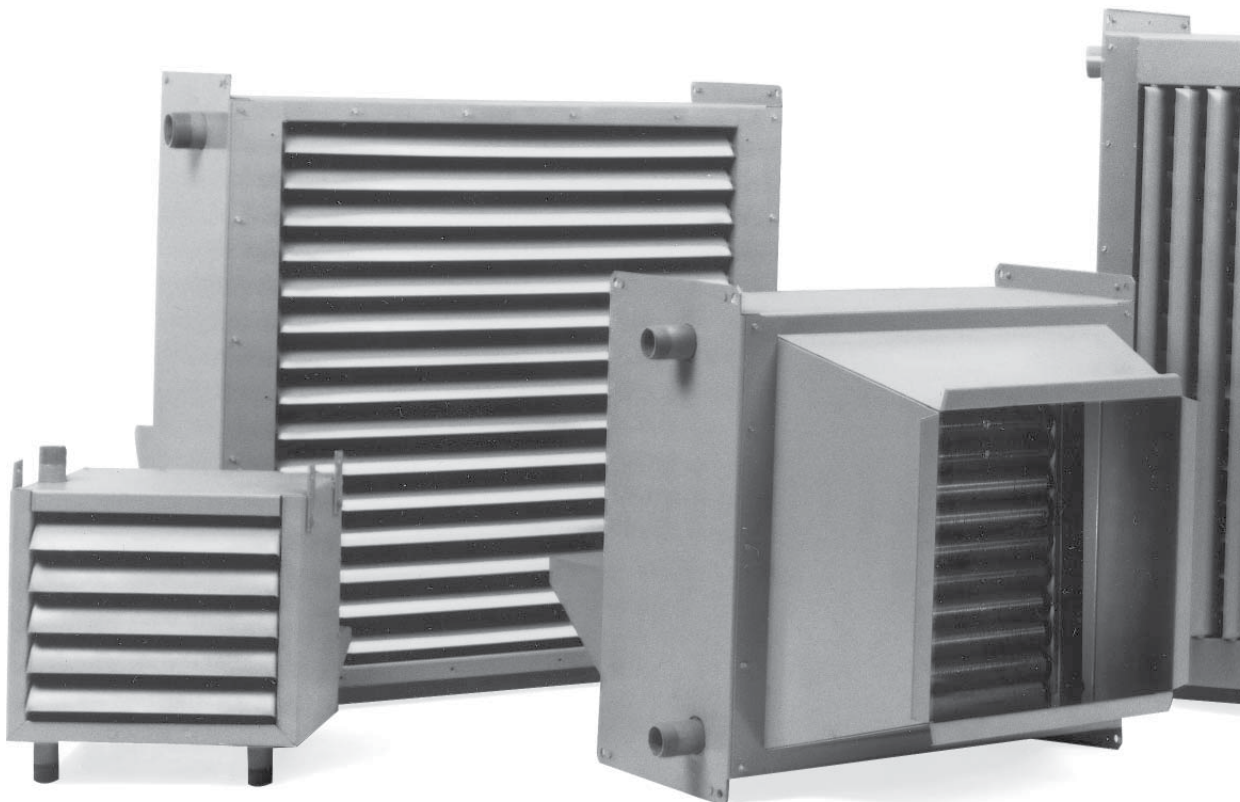
Consider these measurable benefits at work in your facility:

- **Heavy gauge enclosures:** Fabricated from 14-gauge steel for protection and durability.
- **Corrosion-resistant heating cores:** Cores are fabricated in a full range of materials, including steel, stainless steel, copper and others. Special coatings may be applied to increase resistance to external corrosion. Cores feature all-welded construction for durability and ease of repair. Cores can be steam or liquid compatible and can be used for steam, hot water or glycol heating mediums.

- **Standard NEMA frame TEFC ball bearing motors:** Supplied on all sizes, these heavy-duty motors are totally enclosed to lock out dirt for smooth performance. Quick access to the motor permits easy replacement.
- **Thick fins and tubes:** Constructed of high-strength, corrosion-resistant materials. Fins are available in a wide variety of thicknesses and pitches to withstand high pressure cleaning without damage or distortion.
- **Customizing to your needs:** Fans range in size from 10" to 48", and the wide selection of component materials means long, trouble-free service life.



Lightweight coils don't stand a chance in harsh environments. Armstrong coils survive because they're built as tough as your meanest application.



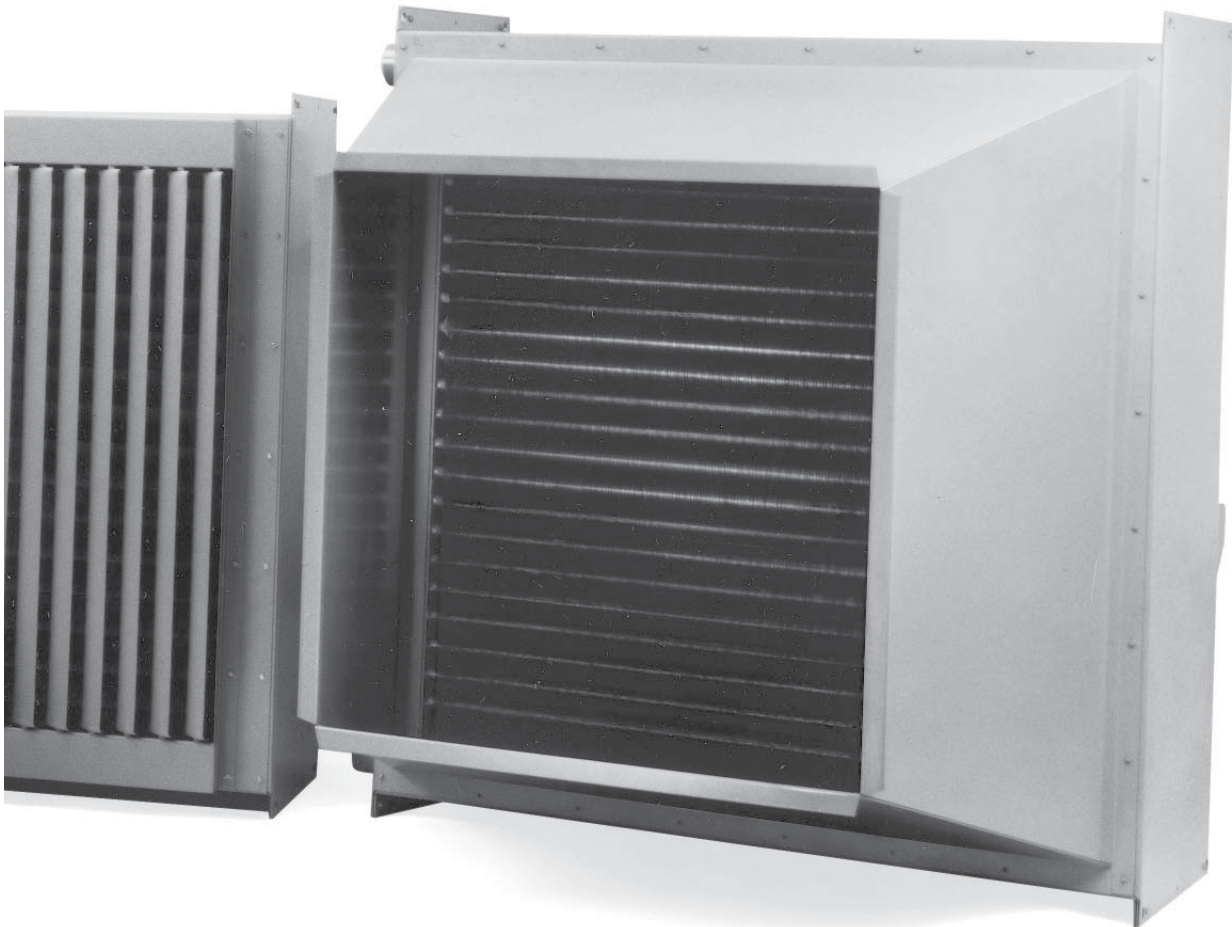
Your Steam Specialist

The first step toward ensuring trouble-free operation is proper unit selection. Your Armstrong Representative will help you select the right unit heater or door heater for any given application.

Our expertise as a manufacturer of unit heaters and door heaters is backed by over 70 years' experience in steam trapping, venting and condensate removal. To you, that

means a superior product and an Armstrong Representative who understands how to make it work in your steam system.

If you're losing heat transfer due to deteriorating coils, contact your Armstrong Representative for a complete application analysis. You'll receive top-quality, reliable products from experts who know how to maximize your steam system efficiency.



Compare the Benefits You Can't See

Many of the best reasons to insist on Armstrong unit heaters and door heaters are ones you never even see. Components like motors, bearings, tubes, enclosures and fins are built heavy-duty to ensure lasting performance.

Armstrong's options for fin material, pitch, height and type, for example, help explain why our heating cores last longer and perform with greater efficiency. These factors all have a bearing on heat transfer. Knowing how to balance these and other factors is the key to a cost-effective solution. That knowledge is perhaps the most important of Armstrong's many hidden benefits.

10"-20" Size

Sturdy Enclosures

Heavy-duty enclosures of 14-gauge steel provide a rigid structure. Aluminum, stainless steel and specially coated enclosures are also available as options.

Standard NEMA Frame TEFC Ball Bearing Motors

Supplied on all sizes, this rugged motor is built to last in tough industrial environments. If replacement is ever needed, motors are readily available from industrial supply dealers, and are easy to install.

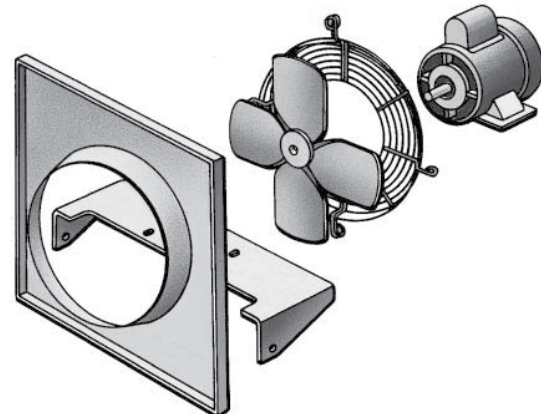
Application Versatility

Because of their heavy-duty construction Armstrong unit heaters are used in many applications. These include product coolers, lube oil coolers, flash steam condensers, hot oil heaters and many others.

Cost-Reducing Strength

Thick fins and tubes withstand pressure cleaning without damage or distortion.

OSHA-Approved Fan Guards Are Standard

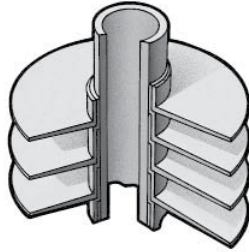


Corrosion Resistance

Fins, tubes and headers are fabricated in a wide variety of metals and alloys, including steel, stainless steel, copper, aluminum and others. Tubes and headers are of the same material to enhance strength and reduce the chance of leakage due to galvanic corrosion.

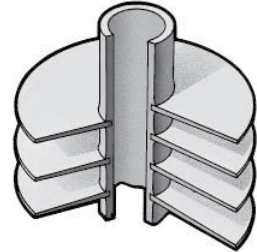
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L Fin



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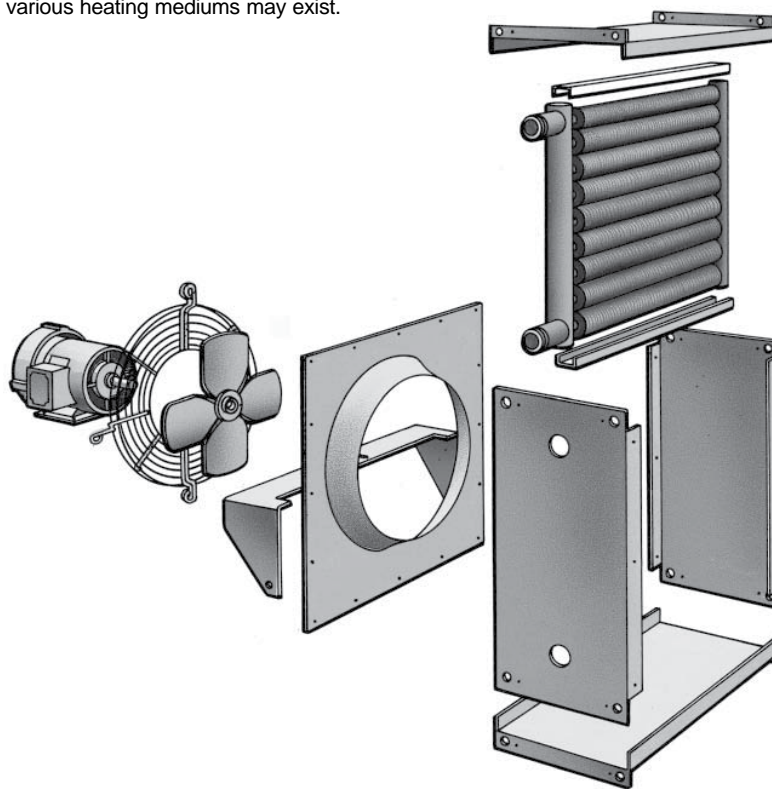
Keyfin



Steam or Liquid Compatible

Cores are available for steam or liquid, allowing units to be applied in different plant areas where various heating mediums may exist.

24"-48" Size

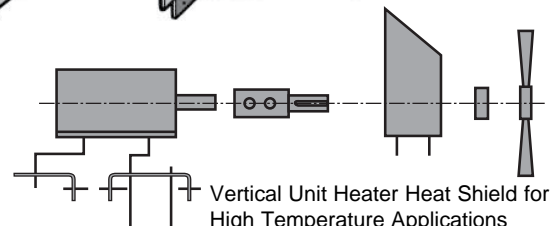


Mounting Flexibility

Basic units may be used in either horizontal or two-way vertical discharge configurations. The addition or substitution of a four-way vertical louver section produces a square discharge pattern. An optional high-velocity discharge nozzle allows the unit to be used as a door heater to temper cold air admitted through open loading-dock doors. High-velocity nozzles may also be used in applications requiring greater mounting heights.

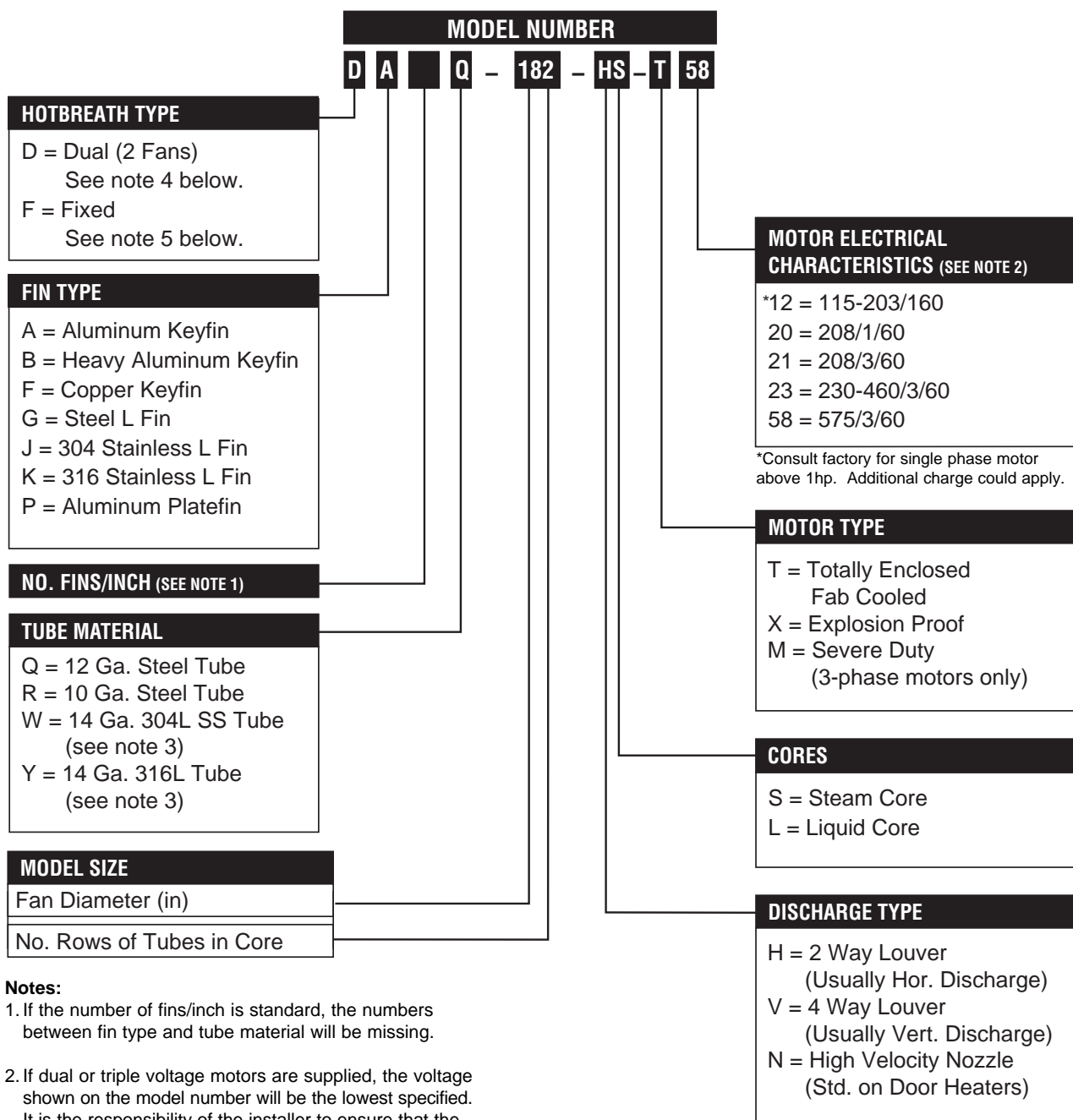
Fan Size Flexibility

Armstrong unit heaters and door heaters are available in fan sizes ranging from 10" to 48".



Vertical Unit Heater Heat Shield for High Temperature Applications
Special purpose motor: 3b
(see page 375)

Model Number Selection



Notes:

1. If the number of fins/inch is standard, the numbers between fin type and tube material will be missing.
2. If dual or triple voltage motors are supplied, the voltage shown on the model number will be the lowest specified. It is the responsibility of the installer to ensure that the motor is wired correctly in accordance with the motor manufacturer's instructions to preclude damage.
3. May be substituted with Sch. 10 SS pipe.
4. Add prefix 'D' for dual units (2 fans on wider core). For standard unit with one fan, the Hotbreath type will be missing.
5. F Models includes larger motors, cleanout lip, ports for sensors.