

W A T L O W

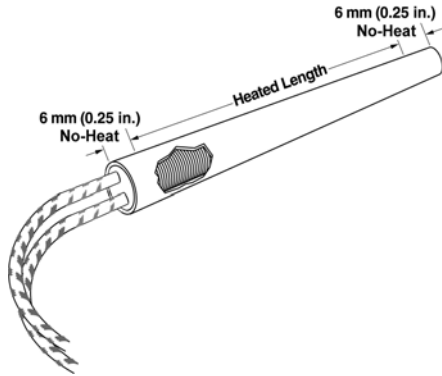
# BEELINE

Watlow GmbH introduces its **BEELINE** Shipment Program. This is a rapid ship delivery program for a large selection of Watlow FIREROD® cartridge heaters.

Watlow now offers its customers a simplified ordering process and a flexible approach to faster product delivery. Because the **BEELINE** Program will allow customers to save on inventory costs, it will save them money and allow them to focus on core business.



# B E E L I N E – T e c h n i c a l D a t a



## Swaged-in Termination

### Swaged-in Flexible Leads

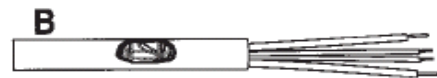
Swaged-in flexible leads, with fiberglass insulation, are recommended for applications where leads need to be bent sharply adjacent to the heater. Unless no longer length is specified, **250 mm (10 inch) leads are supplied.**

Cartridge heaters with 150 mm (6 inches) or shorter in length generally have a 6 mm (0.25 inch) no-heat zone. Heaters with 250 mm (10 inches) in length require a 25 mm (1 inch) no-heat zone, and heaters greater than 250 mm (10 inch) require a no-heat zone greater than 25 mm (1 inch).

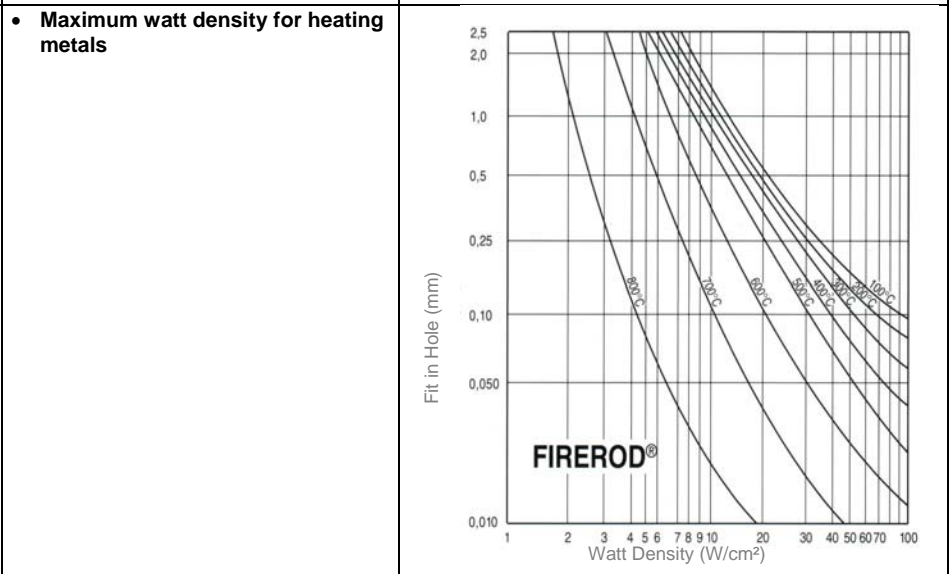
## Internal Thermocouple

### Type J (Fe-CuNi), Type K (NiCr-Ni)

The internal thermocouple located below gives a good approximation of part temperature. The thermocouple junction may be in contact with the inside of the heater sheath, located in the 13 mm (0.5 inch) no-heat section in the center of the heated length. Thermocouples are optional for all diameters and lengths.



Technical Parameter	High performance FIREROD®
<ul style="list-style-type: none"> <li>Cartridge sheath and end-disc</li> </ul>	Incoloy® sheath and fully welded end-disc may have a part temperature of up to 800°C
<ul style="list-style-type: none"> <li>Resistance wire</li> </ul>	NiCr element wire consists of 80% nickel and 20% chromium. (Basic material no. 2.4869 with a melting point over 1250°C)
<ul style="list-style-type: none"> <li>Heat wire carrier</li> </ul>	Highly-compacted magnesium oxide core of high-purity
<ul style="list-style-type: none"> <li>Wattage</li> </ul>	Minimum and maximum value depends on heater dimension
<ul style="list-style-type: none"> <li>Leakage current</li> </ul>	Less than 0.5 mA with heater at room temperature
<ul style="list-style-type: none"> <li>Maximum wattage density</li> </ul>	Up to 62 W/cm²
<ul style="list-style-type: none"> <li>Operating temperature</li> </ul>	Up to 800°C
<ul style="list-style-type: none"> <li>Unheated length</li> </ul>	
at end-disc	approximately 6 mm
at lead end	approximately 6 mm
	For cartridge heaters that are longer than 150 mm with swaged in leads, the no-heat zone at lead end is only 10% of the whole length but at least 25 mm.
<ul style="list-style-type: none"> <li>Tolerances</li> </ul>	
Diameter tolerance	For metric Ø: -0.02 mm to -0.08 mm For imperial Ø: +/- 0.05 mm (+/- 0.002 inch)
Length tolerance	+/- 2% but minimum of +/- 2.4 mm (+/- 0.1 inch)
Wattage tolerance	-5% / +10% at operating temperature
Camber tolerance	0.25 mm (0.01 inch) maximum on any length to 300 mm (12 inches) and 0.17 mm per 100 mm for any lengths over 300 mm
	(Special tolerances upon request)
<ul style="list-style-type: none"> <li>Lead specifications</li> </ul>	
Standard length	250 mm
Stranded wire insulation	Swaged in fiberglass leads (rated for up to 250°C)
<ul style="list-style-type: none"> <li>Agency approvals</li> </ul>	<ul style="list-style-type: none"> <li>CE certified</li> <li>UL recognized (File No. E52951)</li> <li>VDE tested to EN 60335 (VDE 0700 part 1)</li> </ul>
<ul style="list-style-type: none"> <li>Tooling requirements</li> </ul>	H7 based holes provide a good fit for all cartridge heaters (see chart below)
<ul style="list-style-type: none"> <li>Maximum watt density for heating metals</li> </ul>	



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# B E E L I N E – O r d e r i n g l i s t

## Cartridge Heater Type MFE Ø 6.5mm

Order Code	Length (mm)	Voltage (V)	Wattage (W)	Wattage density (W/cm <sup>2</sup> )	Thermocouple	List Price (€)
KMFE0040C012C	40	230	150	24.7		25.00
KMFE0060C004C	60	230	250	24.6		27.20
KMFE0080D013A	80	230	350	34.1		29.50
KMFE0100C026A	100	230	550	30.0		31.80

## Cartridge Heater Type MFF Ø 8.0mm

Order Code	Length (mm)	Voltage (V)	Wattage (W)	Wattage density (W/cm <sup>2</sup> )	Thermocouple	List Price (€)
KMFF0040C004A	40	230	200	25.9		24.20
KMFF0060C024A	60	230	300	23.5		26.50
KMFF0080C006B	80	230	500	28.1		28.60
KMFF0100D021B	100	230	600	34.2		30.80
KMFF0100T007A	100	230	600	34.2	Type K	52.50
KMFF0100T008A	100	230	600	34.2	Type J	52.50
KMFF0130D010A	130	230	700	27.9		34.20

## Cartridge Heater Type MFG Ø 10.0mm

Order Code	Length (mm)	Voltage (V)	Wattage (W)	Wattage density (W/cm <sup>2</sup> )	Thermocouple	List Price (€)
KMFG0040C001A	40	230	250	22.6		23.20
KMFG0060C006B	60	230	400	25.4		25.40
KMFG0080C046A	80	230	550	25.0		27.30
KMFG0080T008A	80	230	550	35.1	Type K	49.00
KMFG0100C044A	100	230	800	28.3		29.50
KMFG0100T008A	100	230	800	36.4	Type J	51.10
KMFG0130C022A	130	230	1,000	26.5		32.60
KMFG0130T003A	130	230	1,000	26.5	Type K	54.30
KMFG0160D027A	160	230	1,100	27.0		35.80
KMFG0160T007A	160	230	1,100	27.0	Type J	57.30
KMFG0200D037A	200	230	1,200	22.5		40.00
KMFG0200T007A	200	230	1,200	22.5	Type K	61.60
KMFG0250D025B	250	230	1,400	20.3		45.20
KMFG0250T003A	250	230	1,400	20.3	Type J	66.80
KMFG0300D030B	300	230	1,500	18.0		50.40

## Cartridge Heater Type MFJ Ø 12.5mm

Order Code	Length (mm)	Voltage (V)	Wattage (W)	Wattage density (W/cm <sup>2</sup> )	Thermocouple	List Price (€)
KMFJ0080C003C	80	230	700	26.3		29.50
KMFJ0100D008A	100	230	1,000	36.5		31.70
KMFJ0130D024A	130	230	1,400	35.8		35.10
KMFJ0130T003A	130	230	1,400	35.8	Type K	56.60
KMFJ0160D018A	160	230	1,700	33.4		38.40
KMFJ0160T007A	160	230	1,700	33.4	Type J	59.90
KMFJ0200D030A	200	230	2,000	30.1		42.80
KMFJ0200T005A	200	230	2,000	30.1	Type K	64.30
KMFJ0250D023A	250	230	2,300	26.7		48.30
KMFJ0250T008A	250	230	2,300	26.7	Type J	70.00
KMFJ0300D020A	300	230	2,500	24.1		53.80

# B E E L I N E – O r d e r i n g l i s t

## Cartridge Heater Type MFL Ø 16.0mm

Order Code	Length (mm)	Voltage (V)	Wattage (W)	Wattage density (W/cm <sup>2</sup> )	Thermocouple	List Price (€)
KMFL0080C017A	80	230	800	25.9		31.50
KMFL0100D004A	100	230	1,000	29.5		34.00
KMFL0130D019A	130	230	1,200	24.5		37.60
KMFL0130T002A	130	230	1,200	24.5	Type K	59.30
KMFL0160D033A	160	230	1,500	23.4		41.30
KMFL0160T003A	160	230	1,500	23.4	Type J	63.00
KMFL0200D030B	200	230	2,000	23.8		46.30
KMFL0200T011A	200	230	2,000	23.8	Type K	67.80
KMFL0250D026A	250	230	2,500	22.9		52.50
KMFL0250T003A	250	230	2,500	22.9	Type J	74.00
KMFL0300D019A	300	230	3,000	22.8		58.60

## Cartridge Heater Type MFN Ø 20.0mm

Order Code	Length (mm)	Voltage (V)	Wattage (W)	Wattage density (W/cm <sup>2</sup> )	Thermocouple	List Price (€)
KMFN0200D023A	200	230	1,500	14.3		52.80
KMFN0200T005A	200	230	1,500	14.3	Type J	74.40
KMFN0250D030A	250	230	2,000	15.4		59.90
KMFN0250T006A	250	230	2,000	15.4	Type K	81.40
KMFN0300D024A	300	230	3,000	19.0		67.00

## Cartridge Heater Type FRE Ø 1/4"

Order Code	Length (inch)	Voltage (V)	Wattage (W)	Wattage density (W/cm <sup>2</sup> )	Thermocouple	List Price (€)
KFRE001AC003C	1	230	100	33.0		24.60
KFRE001JC035A	1 ½	230	200	35.9		26.00
KFRE002AC084A	2	230	250	30.9		27.20
KFRE002JC005A	2 ½	230	300	28.2		28.60

## Cartridge Heater Type FRG Ø 3/8"

Order Code	Length (inch)	Voltage (V)	Wattage (W)	Wattage density (W/cm <sup>2</sup> )	Thermocouple	List Price (€)
KFRG001AC014A	1	230	100	25.3		23.00
KFRG001JC078A	1 ½	230	250	32.2		24.40
KFRG002AC008A	2	230	400	34.6		25.50
KFRG002JC023A	2 ½	230	500	32.6		26.80
KFRG003AC062A	3	230	600	31.3		28.10
KFRG003JC013A	3 ½	230	700	30.5		29.30
KFRG004AC039A	4	230	800	29.9		30.50
KFRG005AD015A	5	230	1,000	34.5		33.10
KFRG006AD022A	6	230	1,200	32.8		35.50
KFRG006AT004A	6	230	1,200	32.8	Type K	57.10
KFRG008AD028A	8	230	1,400	27.0		40.60
KFRG008AT005A	8	230	1,400	27.0	Type J	62.10

## Cartridge Heater Type FRI Ø 1/2"

Order Code	Length (inch)	Voltage (V)	Wattage (W)	Wattage density (W/cm <sup>2</sup> )	Thermocouple	List Price (€)
KFRJ002AC005D	2	230	400	26.0		27.20
KFRJ002JC009C	2 ½	230	500	24.5		28.60
KFRJ003AC041A	3	230	650	25.5		29.90

# B E E L I N E – O r d e r i n g l i s t

## Cartridge Heater Type FRI Ø 1/2"

Order Code	Length (inch)	Voltage (V)	Wattage (W)	Wattage density (W/cm <sup>2</sup> )	Thermocouple	List Price (€)
KFRJ003JC007A	3 ½	230	800	26.2		31.30
KFRJ004AD015A	4	230	1,000	35.2		32.60
KFRJ005AD022A	5	230	1,200	31.1		35.30
KFRJ005AT003A	5	230	1,200	31.1	Type K	56.90
KFRJ006AD029A	6	230	1,400	28.7		37.90
KFRJ006AT005A	6	230	1,400	28.7	Type J	59.60
KFRJ008AD028A	8	230	1,600	23.2		43.40

## Cartridge Heater Type FRL Ø 5/8"

Order Code	Length (inch)	Voltage (V)	Wattage (W)	Wattage density (W/cm <sup>2</sup> )	Thermocouple	List Price (€)
KFRL003AC009A	3	230	600	15.7		32.00
KFRL003JC003A	3 ½	230	800	22.8		33.50
KFRL004AD012A	4	230	1,000	29.1		35.00
KFRL005AD012A	5	230	1,200	25.5		37.90
KFRL006AD020A	6	230	1,400	23.4		40.80
KFRL008AD012A	8	230	1,600	18.8		46.60
KFRL008AT003A	8	230	1,600	18.8	Type K	68.20
KFRL010AD019A	10	230	2,000	18.1		52.60
KFRL010AT003A	10	230	2,000	18.1	Type J	74.10
KFRL012AD013A	12	230	2,200	16.5		58.40

## Cartridge Heater Type FRN Ø 3/4"

Order Code	Length (inch)	Voltage (V)	Wattage (W)	Wattage density (W/cm <sup>2</sup> )	Thermocouple	List Price (€)
KFRN003JD001A	3 ½	230	600	18.0		39.20
KFRN004AD004A	4	230	800	19.5		41.60
KFRN005AD004A	5	230	1,000	17.8		46.20
KFRN005AT002A	5	230	1,000	17.8	Type K	67.70
KFRN006AD005A	6	230	1,200	16.8		50.80
KFRN006AT003A	6	230	1,200	16.8	Type J	72.40
KFRN008AD007A	8	230	1,400	13.8		60.00
KFRN010AD003A	10	230	1,600	12.1		69.20
KFRN010AT002A	10	230	1,600	12.1	Type K	90.80
KFRN012AD005A	12	230	1,800	11.3		78.40
KFRN012AT002A	12	230	1,800	11.3	Type J	100.10
KFRN024AD002A	24	230	2,500	7.7		133.70



**1. Area of applicability:**

- Our sales and delivery terms and conditions apply to all of our business transactions to the extent that the customer is an enterprise, a public law legal person or a public law special entity (Sec. 310 para. 1 BGB [German Civil Code]). The terms and conditions also apply when we render delivery without reservation while knowing of contrasting or varying terms and conditions; such contrasting or varying terms and conditions are binding for us only if we have expressly approved of their applicability in writing.

**2. Execution of the contract:**

- If we confirm the execution of the contract (order confirmation), then the contract is deemed to have entered into effect with the confirmed terms and conditions, if the customer does not, without delay after delivery of the order confirmation, protest these terms and conditions in writing. We reserve our right to vary from the agreed performance to the extent and in a manner that is reasonable.

**3. Prices:**

- If nothing different from this is agreed, our prices are net prices *ex works* and without packaging.
- We have the right to pass along to the customer material and wage cost increases, after execution of the contract, by way of a percentage surcharge that comports with the increase.

**4. Delivery:**

- We have the right to make partial deliveries.
- Unavoidable variations caused by production (tolerances) must be considered in conjunction with statements about technical characteristics of our products such as e.g. power consumption, thermal stability, surface load.
- The delivery deadlines that we specify apply with the reservation that all the documents that the customer is to supply and also production materials have been received in due time.
- All acts of God that prevent the acquisition of raw materials or our production work or deliveries give us the right to extend the delivery target accordingly or to withdraw entirely from the contract without damages restitution claims accruing to the customer from such extension or withdrawal.
- Our policy is to transfer the products at our registered office.
- If our products are to be sent out, then the risk of accidental loss and accidental worsening transfers to the customer upon the products being transferred to the shipping company, this also applies if we do not perform the transfer to the shipping company or if we make use of our own employees for the delivery. Offloading is performed onto level ground and the customer supplies employees or third-party help. Insurance is in effect only upon the express instruction of the customer and is then issued in the customer's name and at the customer's cost; administration for any insurance claim is the customer's sole responsibility.

**5. Warranty of lack of defects:**

- Delivered product must be examined without delay after it has passed into the possession of the customer. Defects, missing quantities and other variations from the agreed performance must be protested without delay after they have been determined to exist. If the actual delivered amount (piece, weight) varies from the quantity statements in the product's accompanying paper (delivery invoice, delivery document), then the customer must protest this upon taking possession of the delivered product and, indeed, in the event of shipping, relative to the last delivery company, otherwise an added quantity is deemed approved and, or the claim to and delivery of a missing quantity is precluded.
- We render makeup delivery upon the prompt and justified complaint of there being a defect:
- We decide whether to take the defective product back and deliver unobjectionable product or remedy the defect. If the purchase price is already due and payable at the point in time of the delivery of the complaint of a defect, then we are obligated to render make up delivery only if the customer has rendered that portion of the purchase price that matches the value of the product in the defective state.
- In the event of unsuccessful make-up delivery, the customer has the choice of reducing the purchase price or withdrawing from the contract. Subject to the provision of No. 6 below, more extensive claims by the customer - regardless of the legal reason for such claims - are precluded.
- Upon a defect that only insubstantially reduces the value or the serviceability of the product, the customer can neither demand make-up delivery nor reduce the purchase price.
- If the defect is based upon a discrepancy relative to advertising claims for characteristics of the product, then the buyer must prove that the advertising was causal for its decision to buy.

**6. Damages- and expenses restitution:**

- We are liable for damages restitution in general only if the damages are based upon intentional or grossly negligent violation of duty that either we ourselves or our employees or third-party helpers have committed. This does not apply to damages restitution based on bodily injury. For restitution claims based on non-delivery or based on default, this limitation of liability does not apply. The customer can demand restitution for fruitless efforts only in the event of intentional or grossly negligent violation of duty on our part.

**7. Time limitation for the claims of defect:**

- Claims based on defective performance can no longer be filed two years after the respective delivery.

**8. Payment terms and conditions:**

- Apportioned tool- and tooling costs must be paid immediately, without discount, upon placing the order.
- Payment for sample product must be rendered immediately without discount upon receipt of the bill.
- All other deliveries are due and payable within 30 days after the billing date without any discount.
- A possible statutory right of the customer to refuse performance remains in full force and effect. Our policy is to refuse to accept checks and negotiable instruments from third parties; we generally are not liable for prompt submission and protest. Our employees are authorized to collect payments only upon submission of a written payment collection authorization.
- If we learn, after execution of the contract, of facts that concern the asset relationships of the customer and that appear to seriously endanger our claim to the purchase price, then we can refuse to deliver until the purchase price is paid or security for the purchase price has been rendered.
- In the event of payment default, we can make performing standing orders - including based on other contracts that we have executed with the customer - dependent upon the simultaneous payment of the purchase price or the simultaneous rendering of appropriate security. After additional warning and fruitless expiration of a supplemental deadline that is appropriate and stipulated in such additional warning, we can withdraw from individual or from all of the contracts executed with the customers to the extent that the contracts have not yet been performed or have been performed only partially, and we can also demand damages restitution for non-performance without this requiring a corresponding announcement (threat of refusal); additionally, we can make all of our claims against the customer due and payable and can liquidate our securities. The statutory claims upon payment default remain moreover in full force and effect.
- Upon that due and payable date, we calculate maturity interest in an amount of 8% above the respective prime rate.

**9. Set off, right to retain possession:**

- The customer can perform setoff only with an undisputed claim or with a claim that is determined with legal finality to exist and a right of retained possession can be exercised only for undisputed counterclaims or for counterclaims that have been determined with legal finality to exist and that are based on the same contractual relationship.

**10. Reservation of ownership:**

- Our deliveries are, without exception, subject to a reservation of ownership. The ownership of the products that we deliver passes to the customer only after the customer has performed all of its obligations based on the business relationship and after all of the negotiable obligations and check law obligations into which we have entered at the request of the customer has been resolved.
- The customer may join or mix products that are subject to the reservation with other things only in the normal and customary course of doing business and may process or dispose of products that are subject to the reservation only in the normal and customary course of doing business. In particular, the customer may not make such products the subject of a pledge or use them as security.
- If products subject to the reservation of ownership are inseparably mixed or mixed in with other things or so joined to another thing (the main thing) that the products become an essential component part of that thing, then there is agreement that the joint ownership to the aggregate quantity or to the main thing in proportion to the invoice value of the product subject to the reservation of ownership relative to the invoice value of the other thing or to the main thing at the point time of the mixing or the mixing in passes to us, and that the customer will be the bailee of the main thing for us at no charge and be liable to act with due business care.
- Processing products that are subject to a reservation of ownership occurs always for us such that no obligations arise from that for us. If, simultaneously, products from other suppliers are being processed that are also subject to reservation of ownership, then No. 10.3 applies accordingly.
- If products that are subject to our reservation of ownership become the subject matter of a purchase contract or a contract to manufacture or other kind of contract of the customer with a third party, which contract provides that the third party acquires ownership to such products, then the customer, even now, transfers its claims to the consideration in the amount of the purchase price and additionally a lump-sum surcharge of 15% for interest and costs; we accept this transfer even now. The customer may not agree to a bar to transfer with its contracting partner and, for the customer's part, deliver only under reservation of ownership; upon demand, the customer must name its contracting partner to us and grant or hand over to us the information and documents necessary for the prosecution of our rights. The customer is authorized to collect the transferred claim notwithstanding our authority to collect the claim ourselves; we ourselves will collect the claim only if the customer enters into payment default or loss of assets - a petition is filed for starting insolvency- or settlement proceedings or cessation of payments.
- The customer must inform us without delay of garnishment and other attachments of products that are subject to our reservation of ownership and, as the case may be, must send us a copy of the garnishment or attachment order.
- If the value of our securities exceeds the aggregate amount of our claims (including negotiable and check law conditional claims) by more than 20 percent, then we will release securities of our choosing upon the demand of the customer.

**11. Copyrights:**

- We reserve our rights of ownership and copyright to cost estimates, drawings and other documents. Transferring disposal rights requires a separate written agreement.

**12. Protective rights:**

- If manufacturing of the products takes place with delivered components of the customer or in accordance with the customer's technical requirements, then the customer must assure itself that protective rights of third parties are not being infringed upon. If third parties claim the violation of protective rights, then the customer will release us of any and all claims.

**13. Customer account:**

- If we maintain a customer account, then that is not linked to effects of the current account.

**14. Applicable Law:**

- German law is to be applied to the contractual relationship. The language of the contract is German to the extent that negotiations are not conducted in English.

**15. Judicial venue:**

- Judicial venue for disputes arising from the business relationship is the Bruchsal Civil Court, if the legal controversy is within the jurisdiction of the civil courts, and is the Karlsruhe Regional Court if the legal controversy is subject to the jurisdiction of the regional court.

