Stelcar™ JK™135

$75\%Cr_3Cr_2/25\%[80Ni/20Cr]$

Technical Note

DATE : 8/13/93
SUPERSEDES : 9/6/88
NO : C-020

DESCRIPTION

Stelcar JK135 powder is manufactured by the agglomeration and sintering of fine particles of chromium carbide and a nickel/chrome alloy. Coatings of this material are resistant to abrasion, particle erosion, impact wear, fretting wear at low and elevated temperatures. The coating has good corrosion resistance in a wide range of environments. JK135 coatings have demonstrated similar and in many situations superior performance compared to Praxair D-Gun coating LC-1C, even though JK135 contains less chromium carbide particles by weight.

JK135 powder is approved for General Electric Material Specification B50TF263, CLB. JK135 coatings produced by operating parameters Set C is approved for coating specification F50TF77, CLA and CLB.

APPROXIMATE COMPOSITION, Wt.%

Carbon	9.7
Chromium	Balance
Nickel	20.0

MESH SIZE

270/D

APPLICATIONS

Hardfacing of nuclear electric power check and flow control valve seats and seals, also paper drying cylinders, pump casings, pump impellers, pump plungers, pump sleeves, mechanical seal faces, feed screws, gate valves, marine components, aircraft compressor and turbine blade for impact wear and erosion resistance and aircraft engine stage seal areas, as well as various chemical and petrochemical parts such as ball valves, cat cracker valve stems, and guides, also heat exchanger components, furnace blowers, fans, thermowells, also gas turbine bearing journals, steam valve seats and compressor rods.

COATING CHARACTERISTICS - PROPYLENE FUEL

	SET A	SET B
Bond Strength, PSI (per ASTM 633)	Unknown	11,000+
Microhardness, DPH [300g]	613-718	700-909
Macrohardness, 15N	88.0-89.3	87.6-91.4
Estimated Porosity, As-Sprayed	1.5%	<1%
Est. Oxide Level, visual Appearance	8-15%	10-20%
Maximum Coating Thickness, Inches As-Sprayed, Flat or Irregular Shapes	.020	.040
Maximum Coating Thickness, Inches As-Sprayed on Cylindrical Shapes	Unknown	Unknown
Est. Maximum Service Temperature, °F	1800	1800
Est. Deposit Efficiency, %	49.0	49.0
Estimated Coverage, Lb/Ft^2/.010"	.7	.7
Est. Surface Finish, Microinch AA	200-300	172-258
Abrasive Wear Resistance, MM^3 Loss Per ASTM G65-80, 2000 Revolutions	Unknown	3.2

COATING CHARACTERISTICS - HYDROGEN FUEL

	SET C*	SET D**
Bond Strength, PSI (per ASTM 633)	10,000+	Unknown
Microhardness, DPH [300g]	732-871	776-939
Macrohardness, 15N	87.5-90.3	88.3-91.2
Estimated Porosity, As-Sprayed	<1%	<1%
Est. Oxide Level, Visual Appearance	5-10%	<5%
Unmelted Particles, per Field of View at 200X	<3	<3
Maximum Coating Thickness, Inches As-Sprayed, Flat or Irregular Shapes	.025	.040
Maximum Coating Thickness, Inches As-Sprayed on Cylindrical Shapes	Unknown	.040
Est. Maximum Service Temperature, °F	1800	1800
Est. Deposit Efficiency, %	57%	53%
Estimated Coverage, Lb/Ft^2/.010"	.5	.6
Est. Surface Finish, Microinch AA	100-200	100-200
Abrasive Wear Resistance, MM^3 Loss Per ASTM G65-80, 2000 Revolutions	Unknown	Unknown

* Conforms to General Electric coating specification F50TF77 CLASS A and CLASS B

** Latest parameters under investigation

The above data in no way constitutes a specification. Parameters and other technical information in this document are for guidance only. Stellite Coatings reserves the right to make changes as additional information becomes available.

HEAT TREATING

Heat treating the coating at 1000°F for 72 hours can increase the coating hardness produced by SET C conditions up to approximately 1100 DPH [300g]. This heat treat may increase the coating low angle blast erosion resistance, especially at elevated temperatures.

FINISHING

For many applications JK135 coating can be used in the as-sprayed condition. To improve initial erosion resistance, a wire brush or abrasive flapping wheel can be used to improve the surface texture. Many JK135 coatings require machined surfaces, which must be performed by grinding or lapping.

Light Duty Grinding:

Wheel Type : 100-240 Mesh Resinoid Bonded Diamond Wheel of L, P or R Hardness and Concentration of 50
Cross-Feed Pass: .035" - .050"
Part Surface Speed: 40-50 Feet Per Minute
In-Feed Per Pass: .0005"

Note: Diamond wheels must be dressed periodically to achieve proper cutting and to avoid damage to the coating.

Heavy Duty Grinding:

Use all of the above but substitute a wheel with 100 mesh, nickel clad diamonds in a resinoid bonded matrix, and hardness of R. Large surfaces may require a softer wheel.

NOTE:

1. Important! Diamonds must be periodically relieved by dressing the wheel to insure proper grinding.
2. Irreversible damage to the coating can occur when the grinding wheel specifications and/or the grinding technique is incorrect.
3. Coolant must be flooded onto the part and grinding wheel during grinding.

Lapping:

1. Lapping is best done following a 6-14 microinch AA diamond ground finish of the coating. Lapping as-sprayed coatings is best done by starting with 30 or 45 micron diamond media.
2. Diamond paste or slurry is recommended as lapping media. Diamond film can produce excellent surface finishes with the proper technique and equipment.
3. Do not lap coatings dry. Use a lubricant as recommended for the particular media used in each step. Remove debris, wash and dry the coating surface prior to proceeding to the next grain size. Avoid contamination of the lapping surfaces by cleaning prior to application of fresh media.
4. Recommended grain size progression after grinding :

Lapping Compound	Est. Finish, Microinch AA
15 or 30 Micron	3-5
9 or 15 Micron	2-4
3 or 6 Micron	1-2

5. Superfinishing is possible only if the coating does not have cracks or pull-out caused by improper coating or finishing techniques.

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	SET A OPERATING PARAMETERS(1)	
Fuel Gas	Propylene (C_3H_6)	
Powder Carrier Type	Argon (Ar) or [Nitrogen (N_2)]	
Nozzle	5/16 x 6	
Injector	#50	
Carbide Insert	.052" or .080"	
Console Type	JKII	JKIIA
Manifold Pressures, PSI	(2) (7)	(3)
Oxygen	120	100
Main Fuel Gas	80	80
Carrier Gas	100	85
Hydrogen (Pilot)	25	100
Console Pressures, PSI		
Oxygen	79-87	67-80
Main Fuel	62-73	60-75
Carrier	54-65 (.052")	54-64 (.052")
Console Flows(4)	43-48 (.080")	43-48 (.080")
Oxygen	980-1020	980-1020
Main Fuel	56-60%	133-137
Carrier	30	Ar 56-57
Console Settings		[N_2 67-77]
Oxygen		54.4-56.7
Main Fuel		44.3-45.7
Carrier		Ar 40.1-40.7
Cooling Water(5)		[N_2 67-77]
^oF IN	80-90	80-90
^oF OUT	115-120	115-120
Powder feed Settings		
Dial Set (Approximate)	177-220	177-220
RPM (Approximate)	2.3-3.1	2.3-3.1
Feed Rate (6), grams/Min.	30-40	30-40
Spray Distance, Inches	7-8	7-8

NOTES:

1. Pressures shown are running pressures with powder feeding.
2. Manifold pressures for JKII system are critical, manifold regulators must be located at factory supplied hose ends.
3. Manifold pressure too low will not allow enough flow. If it is too high the controller will pulse upon start up.
4. JKII system does not correct flow due to change in gas temperature or pressures at the meters, JKIIA system compensates and flow is displayed as true Standard Cubic Feet per Hour (SCFH) : T = 0^oC, P = 14.7 PSIA
5. A heat exchanger to control the water inlet temperature to the gun is recommended. Adjust water flow to achieve outlet temperature. Water temperatures may affect coating quality and gun performance.
6. Powder feed rate must be checked with powder flowing through lit gun. Powder Feed Rate (PFR) = (Powder Weight (g) Initial-Powder Weight Final (g)/ Powder Feed Time (min.) Powder feed time must be greater than 1 min. PFR is linear to RPM of the feeder. To achieve required PFR, change RPM as follows:

$$\text{RPM (NEW)} = \frac{\text{PFR (Required) RPM (Original)}}{\text{PFR (Calculated)}}$$

7. JKII flowmeter requires change for specific gas use:
   H_2 - Part #972915 C_3H_6 - Part #972763

DEVELOPMENTAL

SET D OPERATING PARAMETERS(1)

Fuel Gas	Hydrogen (H_2)	
Powder Carrier Type	Argon (Ar)	
Nozzle	1/4 x 6	
Injector	#40	
Carbide Insert	.052" or .080"	
Console Type	JKII	JKIIA
Manifold Pressures, PSI	(2) (7)	(3)
Oxygen	120	90
Main Fuel Gas	120	90
Carrier Gas	100	85
Hydrogen (Pilot)	25	
Console Pressures, PSI		
Oxygen	Unknown	52-62
Main Fuel	Unknown	75-84
Carrier	50-60 (.052")	50-60 (.052")
Console Flows(4)	43-50 (.080")	43-50 (.080")
Oxygen	450-550	450-540
Main Fuel	1200-1300	1220-1290
Carrier	28-32	56-57
Console Settings		
Oxygen		25.0-30.0
Main Fuel		67.7-71.7
Carrier		40.7-41.4
Cooling Water(5)		
^oF IN	80-90	80-90
^oF OUT	115-120	115-120
Powder feed Settings		
Dial Set (Approximate)	215-292	215-292
RPM (Approximate)	3.0-4.5	3.0-4.5
Feed Rate (6), grams/Min.	40-60	40-60
Spray Distance, Inches	7-8	7-8

High spray rates may require 10" distance and faster gun speeds.

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SET B OPERATING PARAMETERS(1)

Fuel Gas	Propylene (C_3H_6)	
Powder Carrier Type	Argon (Ar) or [Nitrogen (N_2)]	
Nozzle	5/16 x 12	
Injector	#50	
Carbide Insert	.052" or .080"	
Console Type	JKII	JKIIA
Manifold Pressures, PSI	(2) (7)	(3)
Oxygen	140	120
Main Fuel Gas	105	100
Carrier Gas	100	85
Hydrogen (Pilot)	25	100
Console Pressures, PSI		
Oxygen	100-112	93-102
Main Fuel	85-90	87-92
Carrier	70-80 (.052")	70-80 (.052")
Console Flows(4)	58-68 (.080")	58-68 (.080")
Oxygen	1200-1220	1260-1300
Main Fuel	65-69%	174-208
Carrier	30-35	Ar 75-80
		[N_2 75-95]
Console Settings		
Oxygen		70.0-72.2
Main Fuel		58.0-69.3
Carrier		Ar 53.6-57.1
		[N_2 75-95]
Cooling Water(5)		
°F IN	80-90	80-90
°F OUT	115-120	115-120
Powder feed Settings		
Dial Set (Approximate)	177-242	177-242
RPM (Approximate)	2.3-3.5	2.3-3.5
Feed Rate (6), grams/Min.	30-45	30-45
Spray Distance, Inches	7-9	7-9

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SET C OPERATING PARAMETERS(1)

Fuel Gas	Hydrogen (H_2)	
Powder Carrier Type	Argon (Ar)	
Nozzle	5/16 x 6	
Injector	#40	
Carbide Insert	.052" or.080"	
Console Type	JKII	JKIIA
Manifold Pressures, PSI	(2) (7)	(3)
Oxygen	120	90
Main Fuel Gas	120	90
Carrier Gas	100	85
Hydrogen (Pilot)	25	
Console Pressures, PSI		
Oxygen	90-95	78-88
Main Fuel	83-88	72-85
Carrier	52-60(.052")	52-60(.052")
Console Flows(4)	45-52(.080")	45-52(.080")
Oxygen	990-1020	1000
Main Fuel	1225	1220
Carrier	30-35	67
Console Settings		
Oxygen		55.6
Main Fuel		67.8
Carrier		47.9
Cooling Water(5)		
^oF IN	80-100	80-100
^oF OUT	110-120	110-120
Powder feed Settings		
Dial Set (Approximate)	125-215	125-215
RPM (Approximate)	1.3-3.0	1.3-3.0
Feed Rate (6), grams/Min.	20-45	20-45
Spray Distance, Inches	8-9	8-9

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