

Stelcar[®] JK[®] 117

83% Tungsten Carbide/17% Cobalt

Technical Note

Date: 12/11/03

Replaces: 7/25/94

NO: C-018

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DESCRIPTION

Stelcar JK[®] 117 powder is manufactured by the agglomeration and sintering of fine particles of tungsten carbide and cobalt. Coatings of this material are resistant to abrasion, particle erosion, fretting wear and other situations, which may involve mild impact. JK[®] 117 coatings appear to be similar to Praxair D-Gun[®] coating LW-1N40.

APPROXIMATE COMPOSITION, Wt.%

Carbon	5.2
Cobalt	17.0
Iron	.5
Tungsten	Balance

SIZE DISTRIBUTION

270 Mesh / 15 micron

APPLICATIONS

Hardfacing of compressor shafts, pump casings, pump impellers, pump plungers, pump sleeves, mechanical seal faces, feed screws, gate valves, marine components, aircraft compressor blade interlocks, aircraft frame components, as well as various chemical and petrochemical parts.

COATING CHARACTERISTICS

	<u>SET A</u>	<u>SET B</u>
Bond Strength, PSI (per ASTM 633)	10,000+	10,000+
Microhardness, DPH [300g]	1055-1243	960-1095
Macrohardness, 15N	89.6-92.4	91.3
Estimated Porosity, As-Sprayed	<1%	<1%
Maximum Coating Thickness, Inches As-Sprayed, Flat or Irregular Shapes	.025	.025
Maximum Coating Thickness, Inches As-Sprayed on Cylindrical Shapes	.030	.030
Est. Maximum Service Temperature, °F	1000	1000
Est. Deposit Efficiency, %	55-60	55
Estimated Coverage, Lb/Ft ² / .010"	1.3-1.4	1.4
Est. Surface Finish, Microinch AA	140-200	100-175
Coating Density, g/cm ³	12.6	12.8
Abrasive Wear Resistance, MM ³ Loss Per ASTM G65-80	4.68	Unknown

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D-Gun is a trademark of Praxair Inc

COATING CHARACTERISTICS CONTINUED

	<u>SET C</u>	<u>SET D</u>	<u>Set E</u>
Bond Strength, PSI (per ASTM 633)	10,000+	10,000+	9,131+
Microhardness, DPH [300g]	932-1285	1097-1285	1230-1259
Macrohardness, 15N	93.1	93.2-94.8	93.7-94.2
Estimated Porosity, As-Sprayed	<.5%	<.5%	<1
Maximum Coating Thickness, Inches As-Sprayed, Flat or Irregular Shapes	.060+	.060+	.031+
Maximum Coating Thickness, Inches As-Sprayed on Cylindrical Shapes	.120+	.120+	.031+
Est. Maximum Service Temperature, °F	1000	1000	1000
Est. Deposit Efficiency, %	48-52	55-60	50-54
Estimated Coverage, Lb/Ft ² / .010"	1.5	1.3-1.4	1.5
Est. Surface Finish, Microinch AA	100-200	100-200	100-200
Coating Density, g/cm ³	13.9	13.9	NA
Abrasive Wear Resistance, MM ³ Loss Per ASTM G65-80	1.12	1.12	NA

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

PARAMETER NOTES (See Pages 4-8):

- Pressures shown are running pressures with powder feeding.
- Manifold pressures for JK[®]II system are critical, manifold regulators must be located at factory supplied hose ends.
- Manifold pressure too low will not allow enough flow. If it is too high the controller will pulse upon start up.
- JK[®]II system does not correct flow due to change in gas temperature or pressures at the meters, JK[®]IIA system compensates and flow is displayed as true Standard Cubic Feet per Hour (SCFH):

$$T = 0 \text{ }^{\circ}\text{C} \quad P = 14.7 \text{ PSIA}$$
- 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 torch performance.
- 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: $\text{RPM (NEW)} = (\text{PFR (Required)} \times \text{RPM (Original)}) / \text{PFR (Calculated)}$
- JK[®]II flowmeter requires change for specific gas use: H_2 - Part #972915 C_3H_6 - Part #972763
- Maximum console inlet gases pressure is 150 PSI.
- Console pressures shown are for JK[®]IIA, JK[®]III pressures are anticipated to be similar but not proven.
- Confirm with Stellite Coatings Engineering group if your JKIIA is capable of running methane gas via your unit H_2 mass-flowmeter, if so then this value may be used to initial establish operating conditions.
- Ignition of JK[®]IIA with methane or natural gas as pilot and main fuel requires ramping the manifold pressure manually from approximately 95 psig to 140 psig during cycle start. If procedure is improperly done the flame may not light and/or the gas could explode violently. To extinguish the flame, the reverse procedure must be used.
- Pressures are shown are for reference. Due to different differential pressures caused by different torch, torch hose bundles and console, conditions shown are significantly broader than reproduced runs with one system. Reproduced ranges on a single Jet Kote[®] system is typically less than 5 psig variation. JK[®]IIA and JK[®]III systems are usually reproduced less than 3 psig variations.

FINISHING

JK[®] 117 Coatings must be finished by wet grinding or lapping using diamond media!

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. The coolant must not contain Amines, which can attack and pit the cobalt matrix!

Recommended Lapping

1. Lapping is best done following a 6-14 microinch AA diamond ground finish of the coating.
2. Diamond paste or slurry is recommended as lapping media. 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.
3. Recommended grain size progression after grinding:

<u>Lapping Compound</u>	<u>Est. Finish, Microinch AA</u>
30 Micron	3-5
15 Micron	2-4
9 Micron	1-2

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

SET A OPERATING PARAMETERS⁽¹⁾

Fuel Gas	Propylene (C ₃ H ₆)		
Powder Carrier Type	Nitrogen (N ₂)		
Nozzle	5/16 x 6		
Injector	#50		
<u>Console Type</u>	<u>JK[®]II</u>	<u>JK[®]II NOVA-A</u>	<u>JK[®]IIA / JK[®]III</u>
<u>Manifold Pressures, PSI</u>	(2) (7)	(8)	(3) (9)
Oxygen	120	120	100
Main Fuel Gas	80	80	80
Carrier Gas	85	80	85
Hydrogen (Pilot)	25	50-120	100
<u>Console Pressures, PSI⁽¹²⁾</u>			
Oxygen	79-87		66-77
Main Fuel	62-73		60-65
Carrier	43-48		43-48
<u>Console Flows⁽⁴⁾</u>			
Oxygen	980-1020	1000-1020	980-1020
Main Fuel	58-60%	115	130-137
Carrier	30-35	57-60	67-77
<u>JK[®]IIA Console Settings</u>			
Oxygen			54.4-56.7
Main Fuel			43.3-45.7
Carrier			67-77
<u>Cooling Water⁽⁵⁾</u>			
°F IN	80-90	80-90	80-90
°F OUT	115-120	115-120	115-120
Flow, GPM	8-9	8-9	8-9
<u>Powder feed Settings</u>			
RPM (Approximate)	1.9-3.8	1.9-3.8	1.9-3.8
Feed Rate ⁽⁶⁾ , grams/Min.	33-66	33-66	33-66
<u>Spray Distance, Inches</u>	7-8	7-8	7-8
<u>Thickness Per Pass, Inches</u>	.001 maximum		
Torch to Part speed, Ft/Min.	200-300		
Torch Move Per Pass, Inch/Rev.	.100		

Preheat Recommended, If Possible

Cooling **AVOID EXTREME COATING TEMPERATURE VARIATIONS!**

- IF USED DIRECTLY ON COATING AREA, STOP WHEN FLAME IS OFF COATING AREA
- AIR COOLING OF UN-COATED AREA PERMITTED

Maximum Part Temperature During Application of Coating is 400°F

Notations above (1-12) please see page 2 for details.

SET B OPERATING PARAMETERS⁽¹⁾

Fuel Gas	Hydrogen (H ₂)		
Powder Carrier Type	Argon (Ar)		
Nozzle	1/4 x 6		
Injector	#40		
<u>Console Type</u>	<u>JK[®]II</u>	<u>JK[®]II NOVA-A</u>	<u>JK[®]IIA / JK[®]III</u>
<u>Manifold Pressures, PSI</u>	(2) (7)	(8)	(3) (9)
Oxygen	120	120	70-100
Main Fuel Gas	120	120	80-100
Carrier Gas	85	85	85
Hydrogen (Pilot)	25		
<u>Console Pressures, PSI⁽¹²⁾</u>			
Oxygen	57-62		55-62
Main Fuel	66-70		63-68
Carrier	47-58		47-58
<u>Console Flows⁽⁴⁾</u>			
Oxygen	575	580	580
Main Fuel	900	870	870
Carrier	28-32	57	57-58
<u>JK[®]IIA Console Settings</u>			
Oxygen			32.2
Main Fuel			48.3
Carrier			40.7-41.4
<u>Cooling Water⁽⁵⁾</u>			
°F IN	80-90	80-90	80-90
°F OUT	115-120	115-120	115-120
Flow, GPM	8-9	8-9	8-9
<u>Powder feed Settings</u>			
RPM (Approximate)	1.5-2.0	1.5-2.0	1.5-2.0
Feed Rate ⁽⁶⁾ , grams/Min.	30-40	30-40	30-40
<u>Spray Distance, Inches</u>	7-8	7-8	7-8
<u>Thickness Per Pass, Inches</u>	.001 maximum		
Torch to Part speed, Ft/Min.	200-300		
Torch Move Per Pass, Inch/Rev.	.100		

Preheat Recommended, If Possible

Cooling

AVOID EXTREME COATING TEMPERATURE VARIATIONS!

- IF USED DIRECTLY ON COATING AREA, STOP WHEN FLAME IS OFF COATING AREA
- AIR COOLING OF UN-COATED AREA PERMITTED

Maximum Part Temperature During Application of Coating is 400°F

Notations above (1-12) please see page 2 for details.

Stelcar[®] JK[®]117

THICK OR THIN COATINGS
UP TO 10 Lb/Hr POWDER RATE
 FOR SMALL AREAS OR SMALL PARTS

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SET C OPERATING PARAMETERS⁽¹⁾

Fuel Gas	Hydrogen (H ₂)		
Powder Carrier Type	Argon (Ar)		
Nozzle	1/4 x 9		
Injector	#40		
<u>Console Type</u>	<u>JK[®] II</u>	<u>JK[®] II NOVA-A</u>	<u>JK[®] IIA / JK[®] III</u>
<u>Manifold Pressures, PSI</u>	(2) (7)	(8)	(3) (9)
Oxygen	120	120	80-100
Main Fuel Gas	120	120	100
Carrier Gas	85	85	85
Hydrogen (Pilot)	25		
<u>Console Pressures, PSI⁽¹²⁾</u>			
Oxygen	65-71		65-71
Main Fuel	78-86		77-84
Carrier	50-57		50-57
<u>Console Flows⁽⁴⁾</u>			
Oxygen	570	570	570
Main Fuel	1250	1150	1150
Carrier	28-32	57	57
<u>JK[®] IIA Console Settings</u>			
Oxygen			31.7
Main Fuel			63.9
Carrier			40.7
<u>Cooling Water⁽⁵⁾</u>			
°F IN	80-90	80-90	80-90
°F OUT	115-120	115-120	115-120
Flow, GPM	11.5-12.5	11.5-12.5	11.5-12.5
<u>Powder feed Settings</u>			
RPM (Approximate)	2.0-5.6	2.0-5.6	2.0-5.6
Feed Rate ⁽⁶⁾ , grams/Min.	30-75	30-75	30-75
<u>Spray Distance, Inches</u>	7-8	7-8	7-8
<u>Thickness Per Pass, Inches</u>	.001 maximum		
Torch to Part speed, Ft/Min.	200-300		
Torch Move Per Pass, Inch/Rev.	.100		

Preheat Recommended, If Possible

Cooling **AVOID EXTREME COATING TEMPERATURE VARIATIONS!**

- IF USED DIRECTLY ON COATING AREA, STOP WHEN FLAME IS OFF COATING AREA
- AIR COOLING OF UN-COATED AREA PERMITTED

Maximum Part Temperature During Application of Coating is 400°F

Notations above (1-12) please see page 2 for details.

Stelcar® JK®117

THICK OR THIN COATINGS
UP TO 20 Lb/Hr POWDER RATE
 FOR LARGE AREAS OR LARGE PARTS

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SET D OPERATING PARAMETERS⁽¹⁾

Fuel Gas	Hydrogen (H ₂)		
Powder Carrier Type	Argon (Ar)		
Nozzle	1/4 x 9		
Injector	#40		
<u>Console Type</u>	<u>JK®II</u>	<u>JK®II NOVA-A</u>	<u>JK®IIA / JK®III</u>
<u>Manifold Pressures, PSI</u>	(2) (7)	(8)	(3) (9)
Oxygen	120	120	80-100
Main Fuel Gas	120	120	100
Carrier Gas	100	85	85
Hydrogen (Pilot)	25		
<u>Console Pressures, PSI⁽¹²⁾</u>			
Oxygen	68-74		68-74
Main Fuel	73-88		81-86
Carrier	58-62		58-62
<u>Console Flows⁽⁴⁾</u>			
Oxygen	570	570	570
Main Fuel	1250	1150	1150
Carrier	28-32	57	57
<u>JK®IIA Console Settings</u>			
Oxygen			31.7
Main Fuel			63.9
Carrier			40.7
<u>Cooling Water⁽⁵⁾</u>			
°F IN	80-90	80-90	80-90
°F OUT	115-120	115-120	115-120
Flow, GPM	11.5-12.5	11.5-12.5	11.5-12.5
<u>Powder feed Settings</u>			
RPM (Approximate)	5.7-11.5	5.7-11.5	5.7-11.5
Feed Rate ⁽⁶⁾ , grams/Min.	76-152	76-152	76-152
<u>Spray Distance, Inches</u>	7-8	7-8	7-8
<u>Thickness Per Pass, Inches</u>	.001-.002		
Torch to Part speed, Ft/Min.	200-400 (faster is better)		
Torch Move Per Pass, Inch/Rev.	.100		

Preheat Recommended, If Possible

Cooling**AVOID EXTREME COATING TEMPERATURE VARIATIONS!**

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- AIR COOLING OF UN-COATED AREA PERMITTED

Maximum Part Temperature During Application of Coating is 400°F

Notations above (1-12) please see page 2 for details.

SET E OPERATING PARAMETERS⁽¹⁾

Fuel Gas	Methane (CH ₄)	
Powder Carrier Type	Nitrogen	
Nozzle	5/16 x 6	
Injector	#50	
<u>Console Type</u>	<u>JK[®]IIA</u>	<u>JK[®]III</u>
<u>Manifold Pressures, PSI</u>	(3) (11)	(9)
Oxygen	100	90-95
Main Fuel Gas	140	90-95
Carrier Gas	85	85
<u>Console Pressures, PSI⁽¹²⁾</u>		
Oxygen	72-82	70-78 (estimated)
Main Fuel	77-85	72-81 (estimated)
Carrier	49-54	49-54
<u>Console Flows⁽⁴⁾</u>		
Oxygen	830	830
Main Fuel	447 (570 H ₂ reading ¹⁰)	447
Carrier	77	77
<u>JK[®]IIA Console Settings</u>		
Oxygen	46.1	
Main Fuel	31.9 (31.7 Using H ₂ flowmeter ¹⁰)	
Carrier	77.0	
<u>Cooling Water⁽⁵⁾</u>		
°F IN	85-95	85-95
°F OUT	115-120	115-120
Flow, GPM	11.8-12.5	11.8-12.5
<u>Powder feed Settings</u>		
RPM (Approximate)	2.6-3.6	2.6-3.6
Feed Rate ⁽⁶⁾ , grams/Min.	32-57	32-57
<u>Spray Distance, Inches</u>	8	8
<u>Thickness Per Pass, Inches</u>	.001 maximum	
Torch to Part speed, Ft/Min.	200-300	
Torch Move Per Pass, Inch/Rev.	.100	

Preheat Recommended, If Possible

Cooling

AVOID EXTREME COATING TEMPERATURE VARIATIONS!

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- AIR COOLING OF UN-COATED AREA PERMITTED

Maximum Part Temperature During Application of Coating is 400°F.

Notations above (1-12) please see page 2 for details.