

JK[®] 6189
Stelcar[®] 6189 Powder
 90% Tungsten Carbide/
 10% Nickel
 Mechanically Alloyed Powder

Technical Note
 DATE: 7/8/02
 SUPERSEDES: 10/7/92
 No: C-037
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DESCRIPTION

Stelcar[®] JK[®] 6189 powder, for JET KOTE[®] Surfacing Systems, produces coatings which applications are similar that Tungsten Carbide/ Cobalt coatings. The substitution of nickel instead of cobalt appears to provide additional corrosion resistance with minimal loss of wear resistance.

| <u>APPROXIMATE COMPOSITION, Wt.%</u> | | <u>MESH SIZE</u> |
|---|---------|-------------------------|
| Carbon | 3.7 | 270/D |
| Iron | 0.5 | |
| Nickel | 10.0 | |
| Tungsten | Balance | |

APPLICATIONS:

Hardfacing of compressor shafts, pump casings, pump impellers, pump plungers, pump sleeves, mechanical seal faces, feed screws, gate valves, marine components, chemical and petrochemical parts.

COATING CHARACTERISTICS

Approximate properties of JK6189 coatings produced by JKII and JKIIA units follow.

| | <u>SET A</u> | <u>SET B</u> | <u>SET C</u> |
|---|---------------------|---------------------|---------------------|
| Bond Strength, PSI (per ASTM 633) | 10,500+ | 10,500+ | 10,700+ |
| Microhardness, DPH [300g] | 867-1043 | 1015 | 912-1119 |
| Macrohardness, 15N | 88.3-90.7 | 89.5 | 89.5-91.6 |
| Estimated Porosity, As-Sprayed | <1% | <2% | <1% |
| Maximum Coating Thickness, Inches As-Sprayed, Flat or Irregular Shapes | .035 | .035 | .030 |
| Maximum Coating Thickness, Inches As-Sprayed on Cylindrical Shapes | Unknown | Unknown | Unknown |
| Est. Maximum Service Temperature, °F | 1000 | 1000 | 1000 |
| Est. Deposit Efficiency, % | 44.4-48.4 | 47.4 | 48.3-50 |
| Estimated Coverage, Lb/Ft/. 010" | 1.5 | 1.4 | 1.3 |
| Est. Surface Finish, Microinch AA | <5 | <5 | <1 |
| Abrasive Wear Resistance, Gram Loss Per ASTM G65-80 (6000 Rev.) | .1729 | | .1385 |

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FINISHING

Coatings of JK[®] 6189 must be finished by grinding or lapping.

Light Duty Grinding :

Wheel Type: 100-240 Mesh Resinoid Bonded Diamond Wheel of L, P or R Hardness.
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.

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 | 1-2 |
| 9 Micron | 1-2 |
| 3 Micron | <1 |

4. Superfinishing 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 | Argon (Ar) or [Nitrogen (N ₂)] |
| Nozzle | 5/16 x 6 |
| Injector | #50 |

| <u>Console Type</u> | <u>JKII</u> | <u>JKIIA</u> |
|--------------------------------|--------------------|------------------------|
| <u>Manifold Pressures, PSI</u> | (2) (7) | (3) |
| Oxygen | 120 | 100 |
| Main Fuel Gas | 80 | 80 |
| Carrier Gas | 100 | 85 |
| Hydrogen (Pilot) | 25 | 100 |
| <u>Console Pressures, PSI</u> | | |
| Oxygen | 75-85 | 62-73 |
| Main Fuel | 60-68 | 54-67 |
| Carrier | 65 | 54-64 |
| <u>Console Flows(4)</u> | | |
| Oxygen | 980-1020 | 980-1020 |
| Main Fuel | 58-60% | 130-137 |
| Carrier | 30-35 | Ar 56-66 |
| <u>Console Settings</u> | | [N ₂ 67-77] |
| Oxygen | | 54.4-56.7 |
| Main Fuel | | 43.3-45.7 |
| Carrier | | Ar 40.0-47.1 |
| <u>Cooling Water(5)</u> | | [N ₂ 67-77] |
| °F IN | 80-90 | 80-90 |
| °F OUT | 115-120 | 115-120 |
| <u>Powder feed Settings</u> | | |
| Dial Set (Approximate) | 136-187 | 136-187 |
| RPM (Approximate) | 1.8-2.5 | 1.8-2.5 |
| Feed Rate (6), grams/Min. | 50-65 | 50-65 |
| <u>Spray Distance, Inches</u> | 7-9 | 7-9 |

NOTES:

- Pressures shown are running pressures with powder feeding.
- Manifold pressures for JKII system are critical, manifold regulators must be located at factory supplied hose ends.
- Manifold pressure too low will not allow enough flow, too high and the controller will pulse upon start up.
- 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°C, P = 14.7 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 torch. 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:

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

- JKII flowmeter requires change for specific gas use: H₂ - Part #972915 C₃H₆ - Part #972763

SET B OPERATING PARAMETERS⁽¹⁾

| | |
|---------------------|--|
| Fuel Gas | Hydrogen (H ₂) |
| Powder Carrier Type | Argon (Ar) or [Nitrogen (N ₂)] |
| Nozzle | 1/4 x 6 |
| Injector | #40 |

| <u>Console Type</u> | <u>JKII</u> | <u>JKIIA</u> |
|--------------------------------|-------------|--------------|
| <u>Manifold Pressures, PSI</u> | (2) (7) | (3) |
| Oxygen | 100 | 90 |
| Main Fuel Gas | 100 | 90 |
| Carrier Gas | 100 | 85 |
| Hydrogen (Pilot) | 25 | |

| | | |
|-------------------------------|-------|-------|
| <u>Console Pressures, PSI</u> | | |
| Oxygen | 59-66 | 57-69 |
| Main Fuel | 65-78 | 62-72 |
| Carrier | 56-65 | 56-64 |

| | | |
|-------------------------|-------|---------------------------|
| <u>Console Flows(4)</u> | | |
| Oxygen | 575 | 580 |
| Main Fuel | 1000 | 870 |
| Carrier | 28-30 | Ar 57 [N ₂ 67] |

| | | |
|-------------------------|--|-------------------------------|
| <u>Console Settings</u> | | |
| Oxygen | | 32.2 |
| Main Fuel | | 48.3 |
| Carrier | | Ar 40.4 [N ₂ 67.0] |

| | | |
|-------------------------|---------|---------|
| <u>Cooling Water(5)</u> | | |
| °F IN | 80-90 | 80-90 |
| °F OUT | 115-120 | 115-120 |

| | | |
|-----------------------------|---------|---------|
| <u>Powder feed Settings</u> | | |
| Dial Set (Approximate) | 152-172 | 152-172 |
| RPM (Approximate) | 1.8-2.2 | 1.8-2.2 |
| Feed Rate (6), grams/Min. | 60-70 | 60-70 |

| | | |
|-------------------------------|-----|-----|
| <u>Spray Distance, Inches</u> | 8-9 | 8-9 |
|-------------------------------|-----|-----|

NOTES:

- Pressures shown are running pressures with powder feeding.
- Manifold pressures for JKII system are critical, manifold regulators must be located at factory supplied hose ends.
- Manifold pressure too low will not allow enough flow, too high and the controller will pulse upon start up.
- 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°C, P = 14.7 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 torch. 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:

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

- JKII flowmeter requires change for specific gas use: H₂ - Part #972915 C₃H₆ - Part #972763

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>JKII</u> | <u>JKIIA</u> |
| <u>Manifold Pressures, PSI</u> | (2) (7) | (3) |
| Oxygen | 120 | 90 |
| Main Fuel Gas | 120 | 90 |
| Carrier Gas | 100 | 85 |
| Hydrogen (Pilot) | 25 | |
| <u>Console Pressures, PSI</u> | | |
| Oxygen | 58-64 | 64-68 |
| Main Fuel | 80-85 | 81-84 |
| Carrier | 59-65 | 57-67 |
| <u>Console Flows⁽⁴⁾</u> | | |
| Oxygen | 525 | 570 |
| Main Fuel | 1200 | 1150 |
| Carrier | 28-30 | 57 |
| <u>Console Settings</u> | | |
| Oxygen | | 31.7 |
| Main Fuel | | 63.9 |
| Carrier | | 40.7 |
| <u>Cooling Water⁽⁵⁾</u> | | |
| °F IN | 80-90 | 80-90 |
| °F OUT | 115-120 | 115-120 |
| <u>Powder feed Settings</u> | | |
| Dial Set (Approximate) | 62-187 | 162-187 |
| RPM (Approximate) | 2.0-2.5 | 2.0-2.5 |
| Feed Rate (6), grams/Min. | 60-75 | 60-75 |
| <u>Spray Distance, Inches</u> | 10 | 10 |

NOTES:

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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°C, 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 torch performance.
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$$\text{RPM (NEW)} = \frac{\text{PFR (Required) RPM (Original)}}{\text{PFR (Calculated)}}$$

7. JKII flowmeter requires change for specific gas use:

H₂ - Part #972915 C₃H₆ - Part #972763