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哈尔滨电机厂有限责任公司
HARBIN ELECTRIC MACHINERY COMPANY LIMITED

焊接结构件表面预处理（喷砂清理）
工艺守则

PROCEDURE SPECIFICATION OF
SURFACE PREPARATION FOR WELDED
CONSTRUCTIONS (GRIT BLASTING)

No 0637-363

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				Rev. B	
				第 1 页	共 1 页
				PAGE 1	OF 1
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哈尔滨电机厂有限
责任公司

HARBIN ELECTRIC MACHINERY
COMPANY LIMITED

焊接结构件表面预处理（喷砂清理）工艺守则
PROCEDURE SPECIFICATION OF SURFACE PREPARATION
FOR WELDED CONSTRUCTIONS (GRIT BLASTING)

0637-363

Rev. B

第 1 页 共 11 页

PAGE 1 OF 11

目录

1. 适用范围	2
Scope	
2. 人员和设备要求	2
Requirements of personnel and equipments	
3. 参照和引用标准	2~3
Reference and applicable standards	
4. 基本要求	3~4
Basic requirements	
5. 喷砂磨料	4~5
Blasting abrasives	
6. 喷砂前对工件的要求	5~6
Requirements for components before grit blasting	
7. 操作要求	6~7
Operation requirements	
8. 质量控制	7~9
Quality control	
9. 安全环保节能要求	11
Requirements of safety, environmental protection and energy saving	

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焊接结构件表面预处理（喷砂清理）工艺守则
PROCEDURE SPECIFICATION OF SURFACE PREPARATION FOR WELDED
CONSTRUCTIONS (GRIT BLASTING)

0637-363

Rev. B

第 2 页 共 11 页

PAGE 2 OF 11

1 适用范围 Scope

本规范适用于哈尔滨电机厂有限责任公司及其合格供方对焊接结构件表面进行清理、预处理的常规要求。

This specification is applied to the general requirements for cleaning and preparation on the surface of welded constructions by HEC and other qualified suppliers.

2 人员和设备要求 Requirements of Personnel and Equipments

2.1 所有操作人员应该熟知本岗位危险源与环境因素，掌握危险因素的防范措施及事故应急措施。

All the operators shall be familiar with dangerous sources and environmental factors of the position and master the precautionary and emergency measures of dangerous factors.

2.2 所有操作人员应该熟知本岗位操作要领和岗位职责。

All the operators shall be familiar with operating essentials and responsibilities of the position.

2.3 所有操作人员在开始工作前必须穿戴好安全防护用具，检查安全防护用具的可靠性。

Before working all the operators shall wear safe and protected tools and also check their reliability.

2.4 所有设备、设施必须符合国家有关标准要求，不可以使用可能给操作人员带来危险或伤害的设备。

All the equipments and facilities shall meet the requirements of national relevant standards. The equipments which might cause dangers and damages to operators are forbidden to use.

2.5 设备相关参数（如电压、电流等）以厂家推荐的参数为准。

Relevant factors (eg. voltages, currents) refer to the recommendation of manufactures.

3 参照和引用标准 Reference and applicable standards

3.1 GB/T 18838.3-2008 涂覆涂料前钢材表面处理喷射清理用金属磨料的技术要求第 3 部分：高碳铸钢丸和砂

GB/T 18838.3-2008 Preparation of steel substrates before application of paints and related products specifications for metallic blast-cleaning abrasives. Part 3: High-carbon cast-steel shot and grit

3.2 GB/T 18839.2-2002 涂覆涂料前钢材表面处理-表面处理方法-磨料喷砂清理

GB/T 18839.2-2002 Preparation of steel substrates before application of paints and related products-Surface preparation methods-Abrasive blast-cleaning

3.3 GB/T 18839.3-2002 涂覆涂料前钢材表面处理-表面处理方法-手工和动力工具清理

焊接结构件表面预处理（喷砂清理）工艺守则
PROCEDURE SPECIFICATION OF SURFACE PREPARATION FOR WELDED
CONSTRUCTIONS (GRIT BLASTING)

0637-363

Rev. B

第 3 页 | 共 11 页

PAGE 3 OF 11

GB/T 18839.3-2002 Preparation of steel substrates before application of paints and related products-Surface preparation methods-Hand-and power-tool cleaning

3.4 GB/T 8923.1-2011 涂覆涂料前钢材表面处理表面清洁度的目视评定第 1 部分：未涂覆过的钢材表面和全面清除原有涂层后钢材表面的锈蚀等级和处理等级

GB/T 8923.1-2011 Preparation of steel substrates before application of paints and related products-Visual assessment of surface cleanliness--Part 1: Rust grades and preparation grades of steel surfaces before application of paints and related products and after cleaning of all initial paints and related products.

3.5 GB/T 2478-2008 普通磨料棕刚玉

GB/T 2478-2008 Conventional abrasive-Brown fused alumina

3.6 GB/T 2481.1-1998 固结磨具用磨料粒度组成的检测和标记第 1 部分：粗磨粒 F4~F220

GB/T 2481.1-1998 Bonded abrasive-Determination and designation of grain size distribution- Part1: Macrogrits F4 to F220

3.7 SAE J444-2005 喷丸和清理用铸造铁丸和磨料粒度规范

Cast Shot and Grit Size Specifications for Peening and Cleaning

3.8 0EA.625.0170 钢铁材料的表面预处理与涂层施工守则

0EA.625.0170 Preparation of steel substrates and coating specification

3.9 0EA.625.005 产品零部件涂漆及防锈系统选择标准

0EA.625.005 Paint and anti-rust system selection criteria for Product components

3.10 ISO8504-2:2000 Preparation of steel substrates before application of paints and related products-Surface preparation methods-Abrasive blast-cleaning

3.11 ISO11124-3:1993 Preparation of steel substrates before application of paints and related products specifications for metallic blast-cleaning abrasives. Part 3: High-carbon cast-steel shot and grit

3.12 ISO8504-3:2000 Preparation of steel substrates before application of paints and related products-Surface preparation methods-Hand-and power-tool cleaning

3.13 ISO8501.1-2007 Preparation of steel substrates before application of paints and related products-Visual assessment of surface cleanliness-Part 1: Rust grades and preparation grades of steel surfaces before application of paints and related products and after cleaning of all initial paints and related products.

3.14 ISO8486.1-1996 Bonded abrasives-determination and designation of grain size distribution-Part1: Macrogrits F4 to F220

4 基本要求 Basic requirements

焊接结构件表面预处理（喷砂清理）工艺守则
PROCEDURE SPECIFICATION OF SURFACE PREPARATION FOR WELDED
CONSTRUCTIONS (GRIT BLASTING)

0637-363

Rev. B

第 4 页 共 11 页

PAGE 4 OF 11

4.1 喷砂清理操作间内，空气相对湿度应低于 85%。

In the blast-cleaning cabinet, RH (relative air humidity) shall be lower than 85%.

4.2 喷砂清理操作期间，钢材表面的温度应至少高于露点 3℃ 以上。

During the blast-cleaning operation, the temperature on the steel surface shall be 3℃ higher than dew point.

4.3 不应该使用合金量超过 7% 的钢砂进行喷砂；污染的钢砂不能再次使用。

It should not be used when alloy content of the steel grit is more than 7%. Contaminated steel grit is forbidden to use.

4.4 喷砂用的压缩空气应该不含有油和水，必要时加装适当的 U 型管和油水分离器。压缩空气压力：0.56Mpa~0.7Mpa

It is free of oil and water in the compressed air for blasting. If necessary, assemble proper U-shape pipe and oil-water separator. Compressed air pressure: 0.56Mpa~0.7Mpa

4.5 喷丸本身不能完全去除油污，如果使用水基涂料，涂漆前要用溶剂或洗涤剂进行局部的清理。

The shot can't clean oil and grease completely. If water-based coating is used, partial cleaning must be performed by solvent or detergent before painting.

4.6 喷砂完成后，当环境相对湿度≤60%时，工件应在 8 小时内涂漆；当 60%<环境相对湿度<85%时，工件应 4 小时内涂漆。

After grit blasting, if the environmental RH is less than 60%, the components shall be painted in 8 hours; if the environmental RH is more than 60% and less than 85%, the components shall be painted in 4 hours.

5 喷砂磨料 Blasting abrasives

5.1 磨料尺寸及类型必须根据待清理钢材的类型、等级和表面状况进行选择，还必须考虑所用喷砂清理系统的类型、预期的表面光洁度和粗糙度以及磨料是否循环使用等因素。通常铸钢砂或铸钢丸按照国家标准 GB/T 18838.3 和国际标准 SAE J444 中相关规定选取。棕刚玉按照国家标准 GB/T 2478 和国际标准 ISO 8486.1 中相关规定选取。公司常用磨料规格为：

高碳铸钢丸 S170 (SAE J444 标准对应：S550) 粒径：1.6mm~1.7mm

高碳铸钢砂 G140 (SAE J444 标准对应：G16) 粒径：1.4mm~1.6mm

棕刚玉 F16 A 级 (ISO 标准对应：F16) 粒径：1.0~1.4mm

The size and type of abrasives must be selected according to the type, grade and surface condition of steels to be cleared. Meanwhile, it shall be considered as follows: type of grit-blasting system, expectant surface roughness, whether recycled or not, etc. Generally, it is selected according to

焊接结构件表面预处理（喷砂清理）工艺守则
PROCEDURE SPECIFICATION OF SURFACE PREPARATION FOR WELDED
CONSTRUCTIONS (GRIT BLASTING)

0637-363

Rev. B

第 5 页 共 11 页

PAGE 5 OF 11

related regulations in National Standard GB/T 18838.3 and International Standard SAE J444 for cast-steel grit and according to National Standard GB/T 2478 and International Standard ISO 8486.1 for Brown fused alumina. The usual abrasives in-house are:

High-carbon cast-shot S170 (SAE J444 S550) particle size: 1.6~1.7mm

High-carbon cast-shot G140 (SAE J444 G16) particle size: 1.4~1.6mm

Brown fused alumina 16# A 级 (ISO 8486.1 F16) particle size: 1.0~1.4mm

5.2 磨料硬度及化学成分符合国家标准 GB/T 18838.3-2008 涂覆涂料前钢材表面处理喷射清理用金属磨料的技术要求第 3 部分：高碳铸钢丸和砂之规定。

The hardness and chemical composition of abrasives shall meet National Standard GB/T 18838.3-2008: Preparation of steel substrates before application of paints and related products specifications for metallic blast-cleaning abrasives. Part 3: High-carbon cast-steel shot and grit.

5.3 磨料含水量的质量分数不大于 0.2%。

The mass fraction of abrasives water content shall be not more than 0.2%.

5.4 可回收的磨料的大小与光洁度在喷砂过程中应该始终能符合本规范的要求。

The size and finish of recycled abrasives shall meet the requirements of this specification throughout the whole blasting process.

5.5 在磨料的使用过程中，应该保证磨料始终是清洁干燥无油的，对施工不造成有害的影响。

In process, it is confirmed that the abrasives are clean, dry and oil-free and won't cause adverse effect on operation.

5.6 奥氏体不锈钢材料不可以使用高碳铸钢丸和高碳铸钢砂进行清理，例如汽轮发电机出线盒等工件。

High-carbon cast-steel shot and grit are forbidden to be used on blasting austenitic stainless steel, such as outlet box of turbo-generator.

5.7 在电磁力作用下，遗留在工件中的钢丸可能对产品产生危害时，不可以使用高碳铸钢丸和高碳铸钢砂进行清理，例如汽轮发电机机座、冷却器外罩等。

Under the condition of electromagnetic force, the steel shot left in the components may be harmful to products. High-carbon cast-steel shot and grit are forbidden to be used on blasting the components, such as stator frame and cooler casing of turbo-generator.

6 喷砂前对工件的要求 Requirements to components before grit blasting

6.1 焊缝及其周边区域的喷砂要求不受本条款限制。

The blasting requirements of welds and their perimeter zone are free of this clause.

6.2 喷砂清理前，可以使用以下工具或方法去除附着在工件表面的油污等杂质：利用钢丝

焊接结构件表面预处理（喷砂清理）工艺守则
PROCEDURE SPECIFICATION OF SURFACE PREPARATION FOR WELDED
CONSTRUCTIONS (GRIT BLASTING)

0637-363

Rev. B

第 6 页 | 共 11 页

PAGE 6 OF 11

刷、角向砂轮机、风铲等工具进行打磨，刮削，或利用丙酮等有机溶剂擦除。

Before grit blasting oil, grease and other foreign materials attached to the components surface can be cleaned by the following tools or methods: grinding and scraping by steel brush, angle grinder, pneumatic digger; rubbing off them by acetone or other organic solvent.

6.3 喷砂清理前，必须去除工艺拉筋、搭板等附着物。利用风铲、角向砂轮机等工具去焊渣、毛刺等。

Before grit blasting, attachments such as bracings and butt straps must be removed. Slags, burrs etc. can be removed by pneumatic digger, angle grinder and other tools.

6.4 喷砂清理前，工件表面不可存在需要返修的裂纹、气孔等缺陷。如果存在，需要修补好再进行喷砂清理。

Before grit blasting, it is free of crack, gas hole and other defects to be repaired on components surface. If the defects exist, repair them firstly and then perform grit blasting.

6.5 对不需要喷砂处理的机加工表面或其他表面，应当采用合适的防护方法进行保护。

Non-blasting machined surface or other surface shall be protected by proper methods.

7 操作要求 Operation requirements

7.1 机械自动喷砂开始前，确认设备处于正常状态：电器绝缘良好、机械部件运转良好。

Before automatic blasting the equipment shall be confirmed on normal status: electrical insulation is fine and mechanical parts operate well.

7.2 喷砂工作期间，喷砂间外人员不可以打开喷砂间的任何观察窗口或门。

During the blasting process, the operators on the outside of blasting cabinet cannot open any observing windows or doors.

7.3 手工操作时，喷嘴到工件表面距离保持 200mm~500mm。

During manual operation, the distance from nozzle to component surface must be maintained at 200mm to 500mm.

7.4 手工操作时，喷射方向与工件表面法线夹角控制在 15° ~ 30° 。

During manual operation, included angle between spraying direction and normal of component surface shall be maintained at 15° to 30° .

7.5 停工观察工件表面喷砂质量前，必须彻底关断风路开关，避免出现安全隐患。

Before shutdown for observing the blasting quality of component surface, the air line must be turn off thoroughly to avoid safety loophole.

7.6 手工操作时，喷嘴孔径由于磨损而增大，正常情况下当其直径增大 25%时需更换喷嘴。

焊接结构件表面预处理（喷砂清理）工艺守则
PROCEDURE SPECIFICATION OF SURFACE PREPARATION FOR WELDED
CONSTRUCTIONS (GRIT BLASTING)

0637-363

Rev. B

第 7 页 共 11 页

PAGE 7 OF 11

如果喷嘴孔径因磨损增大而带来安全隐患，即使没有达到这一数值也必须立即更换。

During manual operation, the nozzle's internal diameter increases because of wearing. Normally the worn nozzle should be replaced when its internal diameter increases by 25%. If the internal diameter's increase caused by wearing may bring about safety loophole, the nozzle must be replaced even the value does not achieve 25%.

7.7 工件表面为加工状态时，喷砂前需要再次确认，避免因操作者遗漏保护而产生质量问题，征得相关人员同意后方可对这些加工位置喷砂处理。

If the surface in the status of machining, it must be confirmed again before blasting, and this can avoid quality problem caused by omitting protection. Only with the agreement of related personnel, these machined positions can be performed grit blasting.

7.8 工件表面有法兰、螺孔、管路、腔隙时，喷砂前应予以充分保护，避免钢丸或砂粒进入这些位置。

If there are flanges, screw holes, pipelines and gaps on component surface, they shall be protected adequately before grit blasting to avoid the entering of steel shot or grit into these positions.

7.9 对于锈蚀较厚的区域、自动机械设备无法达到的区域，需要手工喷砂清理。

The areas of thick corrosion and un-achieved by automatic equipment need grit blasting by hand.

8 质量控制 Quality control

8.1 喷砂后工件不可触摸或踩踏，涂漆前使用干燥的压缩空气、毛刷等方法或工具除去工件表面灰尘。

After grit blasting, it is not allowed to touch and tread. Before painting, the dust on the surface shall be cleaned by dry compressed air, brush or other tools.

8.2 表面粗糙度达到 Rz: 40 μ m~100 μ m。

Surface roughness achieves Rz: 40 μ m~100 μ m.

8.3 不采用放大设备进行观察时，近白色金属喷砂后的表面除了斑痕，必须无任何可见油、油脂、灰尘、脏物、氧化皮、锈、涂料、氧化物、腐蚀产品及其它外来物质，斑痕的情况在 8.4 中说明。

Without observing by magnified devices, it must be free of any visual oil, grease, dust, dirt, scale, rust, coating, oxide, corrosive and any other foreign materials without stains on the surface of nearly white metal after grit blasting. The explanation of stains is shown in item 8.4.

8.4 斑痕所占工件表面比例应该小于单位面积的 5%，该斑痕由锈痕或氧化皮造成的轻微的阴影、轻微的条状或少许的变色。

The proportion of stain on component surface shall be less than 5% of unit area. The stain has light

焊接结构件表面预处理（喷砂清理）工艺守则
PROCEDURE SPECIFICATION OF SURFACE PREPARATION FOR WELDED
CONSTRUCTIONS (GRIT BLASTING)

0637-363

Rev. B

第 8 页 共 11 页

PAGE 8 OF 11

shadow, slight strip or little discoloration caused by iron mold or scale.

8.5 喷砂后检测工件清洁度等级，目检标准符合 GB/T 8923.1-2011(等效采用 ISO8501.1-2007)中对应的级别 Sa2.5 或 Sa3.0。具体级别按照公司标准 0EA.625.005 或其他相关工艺文件选取。

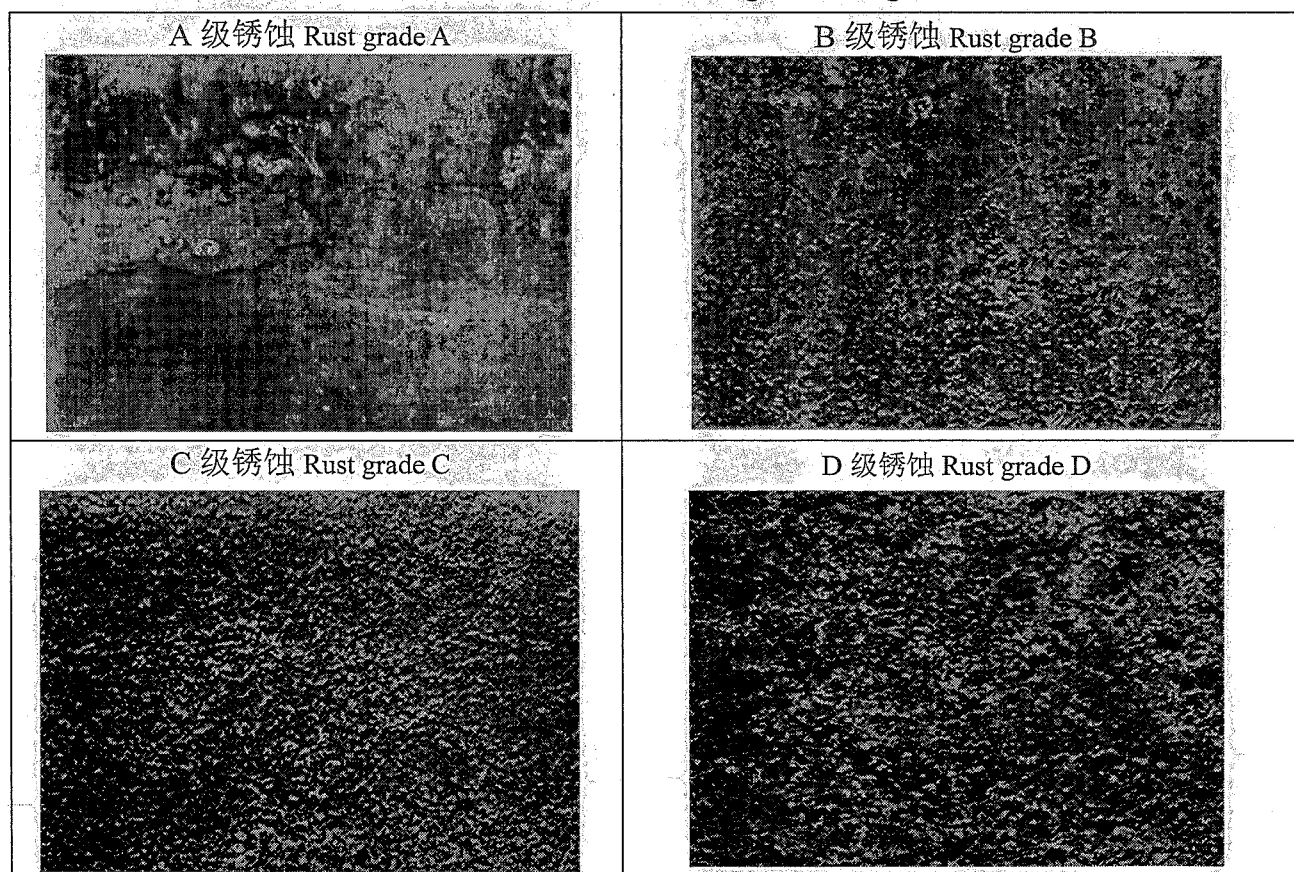
The parts cleanliness level should be checked, and visual inspection standard meets the corresponding level Sa2.5 or Sa 3.0 in GB/T 8923.1-2011 (equaled to ISO 8501.1-2007) . Selection criteria is listed in specification No.0EA.625.005 or other special process documents in detail.

注：表 1 中锈蚀级别对应标准 GB/T 8923.1-2011 涂覆涂料前钢材表面处理表面清洁度的目视评定第 1 部分：未涂覆过的钢材表面和全面清除原有涂层后钢材表面的锈蚀等级和处理等级的相关定义。

Comment: the rust grades correspond with the related definitions in standard GB/T 8923.1-2011 (equaled to ISO 8501.1-2007) : Preparation of steel substrates before application of paints and related products-visual assessment of surface cleanliness--Part 1: Rust grades and preparation grades of steel surfaces before application of paints and related products and after cleaning of all initial paints and related products.

表 1 喷砂质量对照表 Table 1 comparisons of grit blasting quality

喷砂前状态 status before grit blasting



喷砂后状态 status after grit blasting

焊接结构件表面预处理（喷砂清理）工艺守则
PROCEDURE SPECIFICATION OF SURFACE PREPARATION FOR WELDED
CONSTRUCTIONS (GRIT BLASTING)

0637-363

Rev. B

第 9 页 | 共 11 页

PAGE 9 OF 11

A Sa2.5

A Sa3

B Sa2.5

B Sa3

C Sa2.5

C Sa3

D Sa2.5

D Sa3

焊接结构件表面预处理（喷砂清理）工艺守则
PROCEDURE SPECIFICATION OF SURFACE PREPARATION FOR WELDED
CONSTRUCTIONS (GRIT BLASTING)

0637-363

Rev. B

第 10 页 共 11 页

PAGE 10 OF 11

9 安全环保节能要求 Requirements of safety, environmental protection and energy saving

9.1 喷砂操作必须符合公司相关安全环保操作的相关规定。

The operation of grit blasting must meet relevant operating rules about safety and environmental protection in our company.

9.2 由于喷砂间属于密闭狭小空间，工作时应不少于 2 人(通常情况下 1 人操作、1 人监护)。工作时无关人员禁止进入喷砂区域。

The blasting cabinet belongs to airtight and narrow space, so there shall be more than 2 persons (normally one operates and one monitors). During operation, irrelevant personnel are forbidden to enter blasting area.

9.3 开启压缩空气阀门要缓慢操作，压缩空气压力不可以超过 0.75Mpa。

Turn on the valve of compressed air slowly and the pressure must be not more than 0.75Mpa.

9.4 喷砂间地面不可以放置钢丝绳、临时工具等任何杂物，避免影响喷砂操作。

It is free of steel wire rope, temporary tools and any other sundries on the ground of blasting cabinet to avoid affecting operation.

9.5 喷砂工作开始前必须穿戴合适的工作服和防护用具。工作鞋（靴）必须是防滑的，避免因脚下钢丸存在而跌倒或碰伤。

Before grit blasting, it is necessary to wear proper work clothes and protection tools. Work shoes must be anti-skidding to avoid falling down or damaged caused by steel shot underfoot.

9.6 尽量避免高空作业，如必要时必须系好安全带，防止滑落跌伤。

Try to avoid working high above the ground. If need, safety belt shall be necessary to avoid falling down and getting damaged.

9.7 喷砂工作开始前必须确认工件放置平稳，不会因振动或撞击而跌落、移动或翻转。

Before grit blasting, it must be confirmed that components are steady and won't drop, move or roll-over caused by vibration or impaction.

9.8 喷砂设备出现故障时，应由专业人员处理或维修。

When the equipment is in trouble, it should be handled or repaired by professional.

9.9 喷砂间用电器应该是防炸裂的，应该合理的接地，喷砂间照明良好，确保喷砂工作期间不会断电。

The electrical equipment used in blasting cabinet shall be explosion proof and ground connection well. The light in blasting cabinet shall be fine. Also ensure no outage during operation.

9.10 绝对不可以将带有风压或沙砾的工作喷嘴对向人员、门窗、照明设施或其它电器。

It is absolutely forbidden that operating nozzle with air pressure or grit directs to personnel, windows, doors, lighting devices or any other electrical equipments.

9.11 定期检查和维护通风管路、阀门等部位，避免其出现密封不好的情况。储气罐、压力

焊接结构件表面预处理（喷砂清理）工艺守则
PROCEDURE SPECIFICATION OF SURFACE PREPARATION FOR WELDED
CONSTRUCTIONS (GRIT BLASTING)

0637-363

Rev. B

第 11 页 | 共 11 页

PAGE 11 OF 11

表、安全阀必须定期按国家有关标准规定定期检验、校正。

Inspect and maintain airlines, valves and other important positions periodically to avoid bad sealed conditions. Air storage tanks, pressure gauges, safety valves must be inspected and corrected according to relevant codes periodically.

9.12 工作开始前检查通风除尘设备，确保其工作正常。

Before operation, the ventilation and dust removal devices must be inspected to ensure its normal work.

9.13 工作结束后立即关闭压缩空气阀门，按操作说明书要求关闭相关电器开关，通风除尘设备应延迟 5~10 分钟后关闭。

After finishing, shut down the valve of compressed air immediately and turn off relevant electrical equipments according to operation manuals. The ventilation and dust removal devices should be turned off 5~10mins later.

9.14 有机溶剂使用及储存必须符合公司相关规定，操作场地周围 5 米范围内不可以有明火作业，使用前做好防火措施。

The usage and storage of organic solvent must meet relevant rules in company. It is not allowed to work with naked fire within 5 meters of operation field. Before using, fire prevention is necessary.

9.15 使用后的棉纱、剩余有机溶剂统一回收处理，切勿随意储存或丢弃。

The used cotton yarn, surplus organic solvent should be treated unifiedly. Do not store or place at will.

9.16 其他安全环保节能要求参照国家相关标准或相关管理规定。

The other requirements of safety, environmental protection and energy saving refer to relevant standards or administrative regulations.
