# Appendix A

# 附录A

**HAZARD RISK CATEGORY CLASSIFICATION TABLE (Task Tables)**

**危害风险分类表(工作表)**

Personnel Protective Equipment (PPE)

个人安全防护装备(PPE)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Hazard Risk Category  危害风险分类 | PPE Description  PPE叙述 | Minimum Arc Rating cal/cm\*\*2 |
|  | 0 | Minimum of non-melting untreated natural fiber long sleeve shirt and long pants, safety glasses. Additional site PPE requirements may also apply. Note: (a)  至少有不熔化的未经处理的纤维长袖衬衫以及长裤、安全眼镜。额外的现场要求亦适用。Note: (a) | <1.2 |
|  | 1 | Fire resistant (FR) long sleeve shirt and fire resistant pants OR 100% cotton garments and FR coverall, hard hat, safety glasses, and leather gloves or voltage rated gloves (refer to task tables). Notes: (a), (e)  防火(FR)长袖衬衫与防火长裤或100%纯棉服装与工作服、硬质帽、护目镜以及皮革手套或电压等级手套(参见工作表)。附注：(a), (e) | 4 (c) |
|  | 2 | 8 cal/cm\*\*2 arc rated long sleeve shirt and trousers OR full 8 cal/cm\*\*2 arc rated coverall. Plus arc rated face shield and flash protection for head (or flash hood, Nomex gloves or arc flash rated gloves, hard hat, safety glasses and hearing protection. Notes: (a),(b), (d)  8 卡/平方厘米弧光等级的长袖衬衫以及裤子或全8卡/平方厘米防护衣。外加弧光等级的面屏、头部闪火防护帽（防火硬质帽）、Nomex手套或闪火等级手套、硬质帽以及安全眼镜和听力保护。注：(a)、(b)、(d) | 8 (c) |
|  | 4 | Arc rated flash suit and hood, Nomex gloves with leather work gloves as protectors or arc flash rated gloves, safety glasses and hearing protection. Notes: (a), (b) , (d)  电弧等级防闪火套装及帽、以皮革手套为保护或电弧闪火等级手套的Nomex手套、安全眼镜以及听力保护。注：(a)、(b)、(d) | 40 (c) |
|  | 5 | Arc rated flash suit and hood, Nomex gloves with leather work gloves as protectors or arc flash rated gloves, safety glasses and hearing protection. Notes: (a), (b), (d), (f)  电弧等级防闪火套装及帽、以皮革手套为保护或电弧闪火等级手套的Nomex手套、安全眼镜以及听力保护。注：(a)、(b)、(d) | 100 (c) |
|  |  |  |  |

1. Manmade fibers are not to be used as undergarments.

人造纤维不可用于贴身衣物

1. For some tasks, voltage rated gloves must be worn with supplied leather work gloves as protectors, instead of the Nomex gloves or arc flash rated gloves. Please refer to task tables.

对于某些工作、电压等级手套必须穿戴，其以皮革手套为保护，而非Nomex手套或电弧闪火等级手套(见注d)。请参考工作表。

1. This rating is for a single layer garment. Multiple layers of lower rated garments to attain the specified rating is not allowed, unless approved by GSS Electrical Engineering.

此等级为单层衣物。多层等级较低的衣物来达到特定的等级是不允许的，除非GSS 电气工程核准。

1. Fire resistant (FR) clothing and/or gloves that have an equivalent arc flash rating may be substituted for the indicated Nomex PPE.

具有同等电弧闪火等级的防火(FR)衣物可用来替代指定的Nomex PPE。

1. Personnel working in a cell line working zone (CLWZ) are required to wear electrical hazard (EH) rated work boots, in addition to the appropriate PPE as defined in Appendix A. Minimum base electrical PPE in a cell line working zone (CLWZ) shall be Category 1 PPE.

除附录A当中定义的合适的PPE以外，在电解液电池区域(CLWZ)中工作的人员必须穿着电气危害(EH)等级的工作靴。电解液电池区域(CLWZ)当中的最低等级PPE为第1类PPE

(f) Operation and maintenance activities above 40 cal/cm\*\*2 is prohibited. Category 5 PPE may be used in category 4 applications.  
 40卡/平方厘米以上严禁操作和维修活动。第5类PPE可能用在第4类应用中

**Voltage Rated Gloves (I)**

电压等级手套

|  |  |  |  |
| --- | --- | --- | --- |
|  | Class | Maximum DC Voltage Level | Maximum AC Voltage Level |
|  | 分类 | 最高直流电压等级 | 最高直流电压等级 |
|  | 00 | 750 V (II) | 500 V (II) |
|  | 0 | 1500 V (III) | 1000 V (III) |
|  | 2 | 22,500 V (III) | 17,000 V (III) |

1. Gloves must be tested and date stamped every six months, or as required by regional or national standards

手套必须每六个月做测试并盖上日期章，或依照地区或国家标准的要求

1. Leather glove protectors are not required

皮革手套保护是不需要的

1. Must be worn with supplied leather glove protectors to prevent insulation damage

必须有皮革保护以预防绝缘损坏

# Task tables

工作表

# Note: In addition to the following ppe requirements, correct SAFETY AWARENESS qualification is required to perform the task. IN GENERAL, UNLESS OTHERWISE NOTED, ALL EQUIPMENT MUST BE TESTED TO ENSURE EQUIPMENT IS DE-ENERGIZED PRIOR TO PERFORMING ANY TASKS. If voltage rated gloves are INDICATED, they will be used in place of the gloves DESIGNATED in the PPE table

注：除了以下的PPE要求，也需要有正确的安全认知的能力已进行该工作。通常，除非有另外注明，在进行任

何工作之前所有设备必须做过测试以确认设备已经断电。若有指定电压等级手套，它们将用来取代PPE表指定的手套。

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Equipment/Type – Task设备 /类型 –工作 | Hazard/ Risk Category | V-rated Gloves | V-Rated Tools |
|  | Instrumentation equipment rated 240 V and below 240V及其以下的仪表设备 |  |  |  |
|  | Operate circuit breaker or fused switch with covers on. Unless indicted by a specific equipment label to use a different PPE Category.  操作线路断路器或具有外盖的熔断切换器。除非特别设备标明指定使用不同PPE等级。 | 0 | N | N |
|  | Operate circuit breaker or fused switch with covers off. Unless indicted by a specific equipment label to use a different PPE Category.  操作线路断路器或具有外盖的熔断切换器。除非特别设备标明指定使用不同PPE等级。 | 0 | Class 00 | N |
|  | Work on live parts, including voltage testing.  在通电的零件上工作，包括电压测试 | 0 | Class 00 | Y |
|  | Remove bolted covers or open hinged covers to expose live parts, including opening or removing doors or covers.  取下上螺栓的外盖或打开具有枢轴的外盖以曝露通电的零件，包括打开或取下门或外盖 | 0 | N | N |
|  | Work on circuits 30 V and below, or other non-electrical work (tubing, piping, etc.)  在30V以下的线路上工作，或其他非电气工作(接管、配管等) | 0 | N | N |
|  | Work on energized equipment fed directly by a branch circuit of the panelboard.  直接由配电盘的支干线路供电的通电的设备上工作 | 0 | Class 00 | Y |
|  | Removal, testing and replacement of fuses. Approved fuse pulling tools must be used.  移除、测试以及更换保险丝。必须使用批准的保险丝拔取工作 | 0 | Class 00 | Y |
|  |  |  |  |  |
|  | Panelboards and other equipment, rated 240 V and below 240V等级及其以下的配电盘和其它设备 |  |  |  |
|  | Operate circuit breaker or fused switch with covers on. Unless indicted by a specific equipment label to use a different PPE Category. 操作线路断路器或具有外盖的熔断切换器。除非特别设备标明指定使用不同PPE等级。 | 0 | N | N |
|  | Operate circuit breaker or fused switch with covers off. Unless indicted by a specific equipment label to use a different PPE Category. 操作线路断路器或具有外盖的熔断切换器。除非特别设备标明指定使用不同PPE等级。 | 2 | Class 00 | N |
|  | Work on live parts, including voltage testing, and test before touch. 在通电的零件上工作，包括电压测试以及接触前测试 | 2 | Class 00 | Y |
|  | Remove bolted covers or open hinged covers to expose live parts, including opening or removing doors or covers to access test before touch location. 取下上螺栓的外盖或打开具有枢轴的外盖以曝露通电的零件，包括打开或取下门或外盖以在接触点之前进行接近测试 | 2 | N | N |
|  | Work on energized equipment fed directly by a branch circuit of the panelboard.  直接由配电盘的支干线路供电的通电的设备上工作 | 0 | Class 00 | Y |
|  | Removal, testing and replacement of fuses. Approved fuse pulling tools must be used.  移除、测试以及更换保险丝。必须使用批准的保险丝拔取工作 | 2 | Class 00 | Y |
|  | Work on live parts, including voltage testing, and test before touch, in a controlled work environment, such as designated workshops, laboratory, R&D facilities, etc. Unless indicted by a specific equipment label to use a different PPE Category.  在通电的零件上工作，包括电压测试以及接触前测试，在受到控制的工作环境里，例如指定的加工厂、实验室、R&D设施等，除非特别设备标明指定使用不同PPE等级 | 1 (Note 6) | Class 00 | Y |
|  |  |  |  |  |
|  | Panelboards or Switchboards rated >240 V and up to 1000 V (with molded case or insulated -case circuit breakers or fused switches)  配电盘或切换板等级大于240V至1000V(具有模塑外壳或绝缘外壳线路断路器或熔断切换器) |  |  |  |
|  | Operate circuit breaker or fused switch with covers on. Unless indicted by a specific equipment label to use a different PPE Category.  操作线路断路器或具有外盖的熔断切换器。除非特别设备标明指定使用不同PPE等级。 | 0 | N | N |
|  | Operate circuit breaker or fused switch with covers off and/or access doors open. Unless indicted by a specific equipment label to use a different PPE Category.  操作线路断路器或具有外盖的熔断切换器。除非特别设备标明指定使用不同PPE等级。 | 2 | Class 0 | N |
|  | Remove bolted covers or open hinged covers to expose live parts, including opening or removing doors or covers to access test before touch location.  取下上螺栓的外盖或打开具有枢轴的外盖以曝露通电的零件，包括打开或取下门或外盖以在接触点之前进行接近测试 | 2 | N | N |
|  | Test before touch.  接触前测试 | 2 | Class 0 | Y |
|  | Removal, testing and replacement of fuses. Approved fuse pulling tools must be used.  移除、测试以及更换保险丝。必须使用批准的保险丝拔取工作 | 2 | Class 0 | Y |
|  |  |  |  |  |
|  | Up To 1000 V Class Motor Control Centers (MCCs) and Busways  1000V等级电动机控制中心(MCCs)以及汇流道 |  |  |  |
|  | Operate main incoming circuit breaker locally with doors closed. Unless indicted by a specific equipment operating label.  操作附近的主进线路断路器需关闭门。除非有特定的设备操作标识说明。 | 4 | N | N |
|  | Operate fused switch or starter with enclosure doors closed. Unless indicted by a specific equipment label to use a different PPE Category.  操作线路断路器或具有外盖的熔断切换器。除非特别设备标明指定使用不同PPE等级。 | 0 | N | N |
|  | Read a panel meter while operating a meter switch, download or interrogate an electronic protective device or meter with the doors closed.  操作计量器切换器时读取盘面仪表，门闭合时下载或审阅电子保护装置或计量器 | 0 | N | N |
|  | Remove bolted covers or open hinged covers to expose live parts, including opening or removing doors or covers to access test before touch location.  取下上螺栓的外盖或打开具有枢轴的外盖以曝露通电的零件，包括打开或取下门或外盖以在接触点之前进行接近测试 | 2 | N | N |
|  | Diagnostic testing, including voltage testing, >240 V - Qualified personnel only permitted to perform this task.  Test before touch >240 V.  诊断测试，包括电压测试，大于240V –只准合格的人员进行此工作  接触前测试 大于240V | 2  2 | Class 0  Class 0 | Y  Y |
|  | Work on control circuits, 240 V or below, with live parts >240 V present, provided the parts are suitably isolated, insulated or guarded to prevent inadvertent contact by touching or approaching nearer than a safe distance.  在控制线路上工作，其电压在240V以下，且有240V以上的零件暴露，假如零件被恰当地隔离、绝缘或保护以预防因为接触或接近到小于安全距离而导致不小心的导电接触。 | 2 (Note 7) | Class 0 | Y |
|  | Work on control circuits 240 V or below.  在240V以下的线路上工作 | 0 | Class 0 | Y |
|  | Insert or remove individual starter trays, buckets, etc. from MCC, or plug-in devices from busway, Q-EL and Fully Authorized Only permitted to perform this task.  插入或自MCC移除个别的起动盘、篮等，或自汇流路插入，只有EL/完全授权者被准许进行此工作 | 4 or 5 (Note 1) | Class 2 | Y |
|  | Insert, remove, adjust and other work on protective relays or meters with doors open or closed.  当门开启或关闭时，在保护继电器或计量器上进行插入、移除、调整或其他工作 | 2 | N | N |
|  | Removal, testing and replacement of fuses. Approved fuse pulling tools must be used.  Apply safety grounds to de-energized circuits, where applicable, immediately after test before touch.  移除、测试以及更换保险丝。必须使用批准的保险丝拔取工作。  在断电的线路上移除、测试以及更换保险丝，在合适的地方，立即在接触前测试之后 | 2  2 | Class 0  Class 0 | Y  Y |
|  | Insert, remove, adjust and other work on protective relays or meters with doors open or closed.  Apply safety grounds to de-energized circuits, where applicable, immediately after test before touch.  当门开启或关闭时，在保护继电器或计量器上进行插入、移除、调整或其他工作。在合适的地方，接触前测试后立即采用断电回路安全接地。 | 2  2 | N  Class 0 | N  Y |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Equipment/Type – Task  设备/类型 –工作 | Hazard/ Risk Category | V-rated Gloves | V-Rated Tools |
|  |  |  |  |  |
|  | Up To 1000 V Class Switchgear (with power circuit breakers or fused switches)  1000V等级开关装置(具有电力线路断路器或熔断切换器) |  |  |  |
|  | Operate main incoming circuit breaker locally with doors closed. Unless indicted by a specific equipment operating label.  操作附近的主进线路断路器需关闭门。除非有特定的设备操作标识说明。 | 4 | N | N |
|  | Operate fused switch or starter with enclosure doors closed. Unless indicted by a specific equipment label to use a different PPE Category.  操作线路断路器或具有外盖的熔断切换器。除非特别设备标明指定使用不同PPE等级。 | 0 | N | N |
|  | Read a panel meter while operating a meter switch, download or interrogate an electric protective device or meter with the doors closed.  操作计量器切换器时读取盘面仪表，门闭合时下载或审阅电子保护装置或计量器 | 0 | N | N |
|  | Remove bolted covers or open hinged covers to expose live parts, including opening or removing doors or covers to access test before touch location.  取下上螺栓的外盖或打开具有枢轴的外盖以曝露通电的零件，包括打开或取下门或外盖以在接触点之前进行接近测试 | 2 (Note 3) | N | N |
|  | Removal, testing and replacement of fuses. Approved fuse pulling tools must be used.  移除、测试以及更换保险丝。必须使用批准的保险丝拔取工作 | 2 (Note 3) | Class 0 | Y |
|  | Work on control circuits 240 V or below.  Test before touch >240 V.  在240V或以下的线路上工作  接触前测试 大于240V | 0  2 (Note 3) | Class 0  Class 0 | Y  Y |
|  | Work on control circuits, 240 V or below, with live parts >240 V present, provided the parts are suitably isolated, insulated or guarded to prevent inadvertent contact by touching or approaching nearer than a safe distance.  在控制线路上工作，其电压在240V以下，且有240V以上的零件暴露，假如零件被恰当地隔离、绝缘或保护以预防因为接触或接近到小于安全距离而导致不小心的导电接触。 | 2 (Note 3 & 7) | Class 0 | Y |
|  | Insertion or removal (racking) circuit breaker on or off an energized bus with doors open or closed or removing circuit breaker from cubicle.  将电路断电器插入通电的总线或移除(放到架上)，其中门开启或关闭或将断电器自隔间移除 | 4 or 5 (Note 1) | N | N |
|  | Insert, remove, adjust and other work on protective relays or meters with doors open or closed.  当门开启或关闭时，在保护继电器或计量器上进行插入、移除、调整或其他工作 | 2 (Note 3) | N | N |
|  | Apply safety grounds to de-energized circuits, where applicable, immediately after test before touch. 对断电的线路进行安全接地，在合适的地方，立即在接触前测试之后 | 2 (Note 3) | Class 0 | Y |
|  |  |  |  |  |
|  | Other 1000 V Class (>240 V through 1000 V, nominal) Equipment  其他1000V等级 (大于240V至1000V，额定的)设备 |  |  |  |
|  | Remove bolted covers or open hinged covers to expose live parts, including opening or removing doors or covers to access test before touch location.  取下上螺栓的外盖或打开具有枢轴的外盖以曝露通电的零件，包括打开或取下门或外盖以在接触点之前进行接近测试. | 2 | N | N |
|  | Diagnostic testing, including voltage testing, >240 V -- Qualified personnel only permitted to perform this task.  诊断测试，包括电压测试，大于240V –只准合格的人员进行此工作 | 2 | Class 0 | Y |
|  | Insert or remove revenue meters (kW-hour, at primary voltage and current).  插入或移除电能表(千瓦-小时，在最低的电压与电流) | 2 | Class 0 | N |
|  | Remove or install auxiliary gutter or wireway cover, with no exposure of live parts.  移除或安装辅助沟或线槽盖，无通电零件暴露 | 2 | N | N |
|  | Remove or install miscellaneous equipment cover, with no exposure of live parts.  移除或安装辅助沟或线槽盖，无通电零件暴露 | 2 | N | N |
|  | Work on control circuits 240 V or below.  Test before touch >240 V.  在240V以下的线路上工作  接触前测试 大于240V | 0  2 | Class 0  Class 0 | Y  Y |
|  | Work on control circuits, 240 V or below, with live parts >240 V present, provided the parts are suitably isolated, insulated or guarded to prevent inadvertent contact by touching or approaching nearer than a safe distance.  在控制线路上工作，240V以下，其中有大于240V的零件暴露。假如零件恰当的隔离，绝缘或防护以预防不小心接触到或接近距离小于安全间距 | 2(Note 7) | Class 0 | Y |
|  | Insert, remove, adjust and other work on protective relays or meters with doors open or closed.  当门开启或关闭时，在保护继电器或计量器上进行插入、移除、调整或其他工作 | 2 | N | N |
|  | Removal, testing and replacement of fuses. Approved fuse pulling tools must be used.  Apply safety grounds to de-energized circuits, where applicable, immediately after test before touch.  移除、测试以及更换保险丝。必须使用批准的保险丝拔取工作。  在断电的线路上移除、测试以及更换保险丝，在合适的地方，立即在接触前测试之后 | 2  2 | Class 0  Class 0 | Y  Y |
|  |  |  |  |  |
|  | High Voltage Contactor (NEMA E2) Motor Starters, 2.3 kV through 7.2kV  高电压接触器(NEMA E2) 电动机启动器，2.3KV至7.2kV |  |  |  |
|  | Read a panel meter while operating a meter switch, download or interrogate an electronic protective device or meter with the doors closed.  操作计量器切换器时读取盘面仪表，门闭合时下载或审阅电子保护装置或计量器 | 0 | N | N |
|  | Work on circuits 240 V or below with separate control cubicle - Only Q-EL and Fully Authorized permitted to perform this task.  在具有分开控制隔间的240V以下的电路上工作 – 只有Q-EL/完全授权者被准许进行此工作 | 0 | Class 0 | Y |
|  | Insert or remove starters (racking) from cubicles, operate disconnect device with doors open or closed.  将启动器插入或自隔间移除移除(放到架上)、将装置中断连接，其中门开启或关闭 | 4 or 5 (Note 1) | N | Y |
|  | Apply safety grounds to de-energized circuits, where applicable, immediately after test before touch.  在断电的线路上移除、测试以及更换保险丝，在合适的地方，立即在接触前测试之后 | 4 or 5 (Note 1) | Class 2 | Y |
|  | Remove bolted covers or open hinged covers or doors to access test before touch location.  取下上螺栓的外盖或打开具有枢轴的外盖或门以在接触点之前进行接近测试 | 4 or 5 (Note 1) | N | N |
|  | Test before touch. 接触前测试 | 4 or 5 (Note 1) | Class 2 | Y |
|  | Insert, remove, adjust and other work on protective relays or meters with HV cubicle doors closed.  在保护继电器或计量器上进行插入、移除、调整以及其他工作 | 2 | N | N |
|  |  |  |  |  |
|  | Metal Clad Switchgear, 1 kV to 38kV  金属被覆的开关装置，1kV至38kV |  |  |  |
|  | Operate circuit breaker or fused switch with enclosure doors closed and standing in front of the equipment being operated.  箱体门关闭时，操作线路断路器或熔断切换器并站在被操作的设备前面 | 4 or 5 (Note 1) | N | N |
|  | Operate circuit breaker with remote switch or switch device, more than 5 meters away from the circuit breaker, and positioned to either side of the front of the switchgear.  以远程切换器或切换装置操作线路断路器，距离线路断路器5米以上，并且放置在开关装置前端的任一侧 | 0 | N | N |
|  | Read a panel meter while operating a meter switch, download or interrogate an electronic protective device or meter with the doors closed.  操作计量器切换器时读取盘面仪表，门闭合时下载或审阅电子保护装置或计量器 | 0 | N | N |
|  | Insertion or removal (racking) of circuit breaker on or off an energized bus with doors open or closed, operate disconnect device with doors open or closed, or opening of the door to inspect breaker position or to view mechanical cell or breaker mounted indicators or removing circuit breaker from cubicle.  将电路断电器插入通电的总线或移除(放到架上)，其中门开启或闭合，门开启或关闭时操作中断，或打开门以检视机械槽或装有指示器的断电器或自小隔间移除断电器 | 4 or 5 (Note 1) | N | N |
|  | Apply safety grounds to de-energized circuits, where applicable, immediately after test before touch.  对断电的线路进行安全接地，在合适的地方，立即在接触前测试之后 | 4 or 5 (Note 1) | Class 2 | Y |
|  | Open voltage transformer or control power transformer compartments.  开启电压变电器或控制电力变电器隔间 | 4 or 5 (Note 1) | N | N |
|  | Work on control circuits 240 V or below with separate control cubicle - Q-EL and Fully Authorized personnel only permitted to perform this task.  在具有分开控制隔间的240V以下的电路上工作 – 只有Q-EL/完全授权者被准许进行此工作  Work on control circuits 240 V or below with common cubicle and with circuit breaker withdrawn from the bus and safety shutters closed - Q-EL and Fully Authorized personnel only permitted to perform this task.  在具有共通控制隔间以及线路断路器已自总线抽出与安全活门已关闭的240V以下的电路上工作 – 只有Q-EL/完全授权者被准许进行此工作  Work on control circuits 240 V or below with common cubicle and with circuit breaker in the service position - Q-EL and Fully Authorized personnel only permitted to perform this task.  在具有共通控制隔间并且线路断路器在使用位置上的240V以下的电路上工作– 只有Q-EL/完全授权者被准许进行此工作 | 2  2  4 or 5 (Note 1) | Class 0  Class 0  Class 0 | Y  Y  Y |
|  | Remove bolted covers or open hinged covers or doors to access test before touch location.  移除上螺栓的外盖或打开枢转的外盖或门以进行接触前测试 | 4 or 5 (Note 1) | N | N |
|  | Test before touch. 接触前测试 | 4 or 5 (Note 1) | Class 2 | Y |
|  | Insert, remove, adjust and other work on protective relays or meters with HV cubicle doors closed.  HV隔间门关闭时插入、移除、调整以及在保护继电器上进行的工作 | 2 | N | N |
|  | Insert, remove, adjust and other work on protective relays or meters with HV cubicle doors open and breaker in the service position.  HV隔间门关闭并且断路器在使用位置上时插入、移除、调整以及在保护继电器上进行的工作 | 4 or 5 (Note 1) | N | N |
|  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Equipment/Type – Task 设备/类型 –工作 | Hazard/ Risk Category | V-rated Gloves | V-Rated Tools |
|  | Other Equipment 1 kV to 245 kV  其它设备 1kV至245kV |  |  |  |
|  | Metal enclosed load interrupter switches, fused or unfused -- Operate switch, doors closed.  金属包覆的负载断流器的切换器，有熔断或无熔断 – 门关闭时操作切换器 | 4 or 5 (Note 1) | N | N |
|  | Operate outdoor disconnect switch (hookstick operated).  操作户外中断切换器(钩黏型操作) | 4 or 5 (Note 1) | Class 2 | Y |
|  | Operate outdoor disconnect switch operation (gang-operated, from grade).  操作户外中断切换器(同轴操作，自斜坡) | 4 or 5 (Note 1) | Class 2 | N |
|  | Examine insulated cable, in open area, in manhole or other confined space.  检查绝缘的电线，在开放的区域，在人孔或其他局限空间 | (Note 2) | Y (Note 2) | N |
|  | Apply safety grounds to de-energized circuits, where applicable, immediately after test before touch.  施用安全接地以使线路断电，在合适的地方，立即在接触前测试之后 | 4 or 5 (Note 1) | Class 2 | Y |
|  | Work on control circuits 240 V or below with separate control cubicle - Q-EL and Fully Authorized personnel only permitted to perform this task.  在具有分开控制隔间的240V以下的电路上工作 – 只有Q-EL/完全授权者被准许进行此工作 | 2 | Class 0 | Y |
|  | Remove bolted covers or open hinged covers or doors to access test before touch location.  移除上螺栓的外盖或打开枢转的外盖或门以进行接触前测试 | 4 or 5 (Note 1) | N | N |
|  | Test before touch. 接触前测试 | 4 or 5 (Note 1) | Class 2 | Y |
|  | Insert, remove, adjust and other work on protective relays or meters located on a separate panel.  插入、移除、调整以及在保护继电器或位于分开的仪表盘上进行的其他工作 | 2 | N | N |
|  |  |  |  |  |
|  | Battery And Battery Charging Systems  电池以及电池充电系统 |  |  |  |
|  | All work performed on sealed maintenance free, maintenance-free and dry-cell system.  在密封式免保养、免保养以及干电池系统上的所有工作 | 2 | Class 0 | Y |
|  | All work performed on wet-cell systems NOT including cleaning and handling battery fluids.  在湿电池系统上的所有工作，不包括清洁与处理电池液 | 2 (Note 4) | N | Y |
|  | Cleaning and handling battery fluids on wet-cell system.  湿电池系统上清洁与处理电池液 | 2 (Note 5) | N | Y |
|  | Electrolytic Cell Lines Less than 400 Volts DC and Greater than 1,000 Amps DC  电解液电池线路小于直流400伏特与大于1000安培 |  |  |  |
|  | Operate cell switches to Energize (add) a cell into the cell line.  操作电解液电池切换至通电 | 1 | N | N |
|  | Operate cell switches to De-energize (remove) a cell from the cell line.  操作电解液电池切换至断电 | 1 | N | N |
|  |  |  |  |  |
|  | Working inside (CLWZ) (in between energized cells, etc.)  在CLWZ内工作(在通电的电解液电池之间) | 1 | Class 00 | Y |
|  | Test Before Touch of flexible cell cables or cell head/tub with contact volt meter.  在接触可挠性电解液电池电缆或电解头/桶之前以电压计进行测试 | 1 | Class 00 | Y |
|  | Working on De-energized cell with adjacent cells also de-energized.  在邻近电解液电池也是断电的断电电解液电池上工作 | 1 | N | N |
|  | Working on De-energized cell with adjacent cells energized.  在邻近电解液电池通电的断电电解液电池上工作 | 1 | Note 8 | Y |
|  | 500 VDC Insulation Resistance (Megger) Testing of De-energized cell operator shall NOT hold test leads during megger test.  断电的电解液电池操作者的直流500伏特绝缘电阻(Megger)测试不可在进行megger test时握导线 | 1 | N | N |

Notes 注:

1. Depending on site specific assessment. If no assessment is available use Category 4 PPE - The site assessment may indicate the device may not be operated or maintained due to high arc energy levels.

视现场特别的评估状况而定。若无评估则用第4类PPE – 现场评估可能指出因为高电弧能量等级该装置不可操作或保养

1. Site specific risk analysis is required by GSS Electrical Engineering to determine PPE requirements.

现场风险分析需要GSS电气的人员来判断PPE的需求

1. This note was removed at Revision 1 版本1中的该条被移除

(4) In addition to Category 2 PPE, chemical apron must also be used.

除第2类PPE以外，同时必须使用化学围裙

(5) In addition to Category 2 PPE, chemical apron and chemical gloves, instead of Nomex gloves, must also be used.

除第2类PPE以外，同时必须使用化学围裙以及化学手套，而非Nomex手套。

(6) Category 1 is acceptable for circuits fed from transformers rated 50 kVA and lower protected by primary fuses or where fed from a single phase branch circuit. The equipment must be labeled accordingly. If further clarification is needed, contact GSS Electrical Engineering.

第1类对于额定50KV A以下的变电器所供电的线路或单相熔断电路而言是可以接受的。设备必须据实贴标签。若需要进一步 的澄清，连络GSS电气工程。

(7) Where Exposed Live Parts are present that are not suitably isolated, insulated or guarded to prevent inadvertent contact by touching or approaching nearer than a safe distance a site specific risk analysis is required by GSS Electrical Engineering.

暴露的通电零件在工作表内文中有定义，必须恰当地隔绝、绝缘或接地以预防不经意的接触通电或比安全距离还接近

(8) Clean dry leather work gloves are acceptable for this task.

清洁干燥的皮革工作手套对于此工作为可接受的

# Appendix B

附录B

# 

# Motors in Flammable Gas Atmospheres

**存在易燃气体的大气环境中的电机**

**RESPONSIBILITIES OF PLANT PERSONNEL**

**工厂人员的责任**

It is the responsibility of the plant personnel to determine if there is any plant upset, leak, etc., which could expose the motor enclosure to a hazardous gas. This could occur during an unusual operating condition involving a serious flammable gas release where the cloud could engulf the motor for a period of time.

确定工厂是否存在可能导致电机暴露于危险气体的任何操作不稳、泄漏等，是工厂人员的责任。这类情况可能出现在涉及严重易燃气体释放的异常操作条件下，因为易燃气体云可能在电机周围笼罩一段时间

Plant personnel must consider release location, wind direction, and the length of time the cloud may have been in the vicinity of the motor when determining whether to take corrective action or if it is safe to start the motor. The time from the event prior to start-up gives a good indication of possible gas dispersion.

在确定是否采取更正措施或起动电机是否安全的时候，工厂人员必须考虑释放位置、方向和气体云可能已经在电机周围存在的时间。从事故发生之时起至起动前的时间长短是气体扩散的重要指标。

METHODS BY WHICH HAZARDOUS GASES CAN ENTER A MOTOR

危害气体能进入电动机的方式

Hazardous gases can enter the motor three ways:

危险气体可以通过三种途径进入电机

• Through the compressor lube oil system if it is shared jointly with the motor.

如果电机或压缩机共享润滑油系统，可能通过压缩机润滑油系统进入。

• By thermal "breathing" as a motor cools.

当电机冷却时，通过热“呼吸”进入 。

• By inhalation of an air-cooled motor where the ambient air is forced through the motor for motor cooling.

如果用环境空气强制通风冷却电机，可能通过吸入冷却电机的空气进入。

If the plant personnel feel that any of these three possibilities exist as a result of the event, they must take measures to ensure there is no hazardous gas inside the motor before starting the motor.

若工厂人员感觉这三种情况可能导致的后果存在，他们必须采取方法来确认启动前电动机内没有危害气体

ATMOSPHERIC DIFFERENCES IN AND AROUND A MOTOR

电机内外的大气差别

The atmosphere around the motor enclosure may have a very different composition from the atmosphere inside the enclosure after a large cloud has dissipated. At that time there may be more hazardous gases inside the motor than outside.

# 在大量的气体云扩散后，电机壳体周围的大气可能与电机壳体内的大气成分存在很大的区别。在这种情况下，电机内的危险气体浓度可能比电机外的浓度大。

USING GAS-DETECTION PORTS TO DETECT HAZARDOUS GASES

使用气体探测口来探测危险气体

Motors that are equipped with gas-leak detection ports can be checked with a portable LEL detector (explosimeter) to see if a hazardous concentration of flammable gas exists inside the motor.

可以用一种携带型LEL探测器（爆炸计）检查配有气体泄漏探测口的电机，看电机内是否存在危险的易燃气体浓度。

• Using a portable gas detector can be a good indication, but there are places within a motor where gas can collect that may not show up with the testing.

使用携带型气体探测器可能是一种好的检查方式，但是，在积聚气体的电机内，有些地方可能测试不到。

• Motors equipped with purging ports can be purged to remove gas from those places where testing cannot detect the presence of gases. Those without purging ports can have the covers removed and the inside ventilated with an air blower or mover.

配备清洗口的电机可以通过吹扫方式清除不可探测位置的气体。没有配置清洗口的电机，可以拆开机盖，用鼓风机或风机给电机内部通风。

#### MOTORS WITHOUT PERMANENT PURGING EQUIPMENT

无永久性清洗设备的电机

Since the occurrence of a flammable gas release of significant size is not expected to occur very often, permanent purging equipment on all motors is not provided. For these rare occasions, the plant must take the extra time to remove covers, locate blowers, etc., to ensure that there is no hazardous gas inside the motors.

由于发生大量易燃气体泄漏并不常见，所以并不是所有电机上都配置永久性清洗设备。对于偶尔发生的情况，工厂必须花费额外的时间来打开机盖、安装鼓风机等，确保电机内部无危险气体。

**Appendix C1**

**附录C1**

|  |  |
| --- | --- |
| WORK ON LOW VOLTAGE BUS CHECKLIST 在低电压总线上工作的检查表 | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | Facility :  设施 | Date:  日期 | | | | | Plant :  工厂 |  | | | | | Switchroom :  开关室 |  | | | | | Single Line Diagram No.  单线图号 |  | Revision :  修订 | |  | | Electrical Supervisor :  电气监督 |  |  |  | | | Checked :  检查 |  |  |  | | | Associated Permit No.  相关批准号码 |  | | | | | |
|  | This checklist defines the steps and actions required before working on low voltage buses. 'Due to the risk of back feed to the bus a physical break in the electrical supply system is required. This physical break may be, for example withdrawing a withdrawable circuit breaker, removing bus links in a bus duct, removing fuses in a fused switch, removing cable terminations, etc. The opening of a non-withdrawable device such as a disconnect switch, molded case breaker, etc. is acceptable for this purpose, provided the device is lockable in the open position and approved by GSS Electrical Engineering. When each action has been performed sign off the appropriate box.  此检查表定义在低电压总线上工作前所需的步骤。由于回馈给总线的风险，供电系统中的实体断电器是必需的。此实体断路器可能为例如抽出一种可抽出的断路器、在总线导通线路上移除总线链接、在保险断路器上移除保险丝、移除电缆端子等。非可抽出式装置的开路，例如一断路切换器、无熔线断路器等，对于此用途也是可以接受的，假如该装置可锁定在开路位置并且由GSS电气工程核准。每项步骤完成后在正确的栏当中签署。 | |
| The following list defines the actions and steps to be taken :  以下列表定义必须采取的行动与步骤：  WORK ON LOW VOLTAGE BUSES  **在低电压总线上工作** | |
|  | Sign Off |
| 1. Indicate on a copy of the relevant single line diagram the bus to be worked on and the alternate sources of power supply.   在相关单线图的复本上指示必须施工会总线以及电源供应器的替代来源 |  |
| 1. Indicate on a copy of the relevant single line diagram the following information:   在相关单线图的复本上指示以下信息   1. The physical isolation position(s)   实体绝缘的位置   1. The points required to verify isolation by voltage testing.   用电压测试确认绝缘所需的点 |  |
| c) Indicate on a copy of the relevant single line, the sequence of the switching operation required to isolate the normal power supply.  在相关单线图的复本上指示出隔绝正常电源供应所需的切换操作的次序 |  |
| 1. If specific GSS Electrical Engineering authorization is given to modify an existing system to allow the work to be carried out, for example; removal of a key interlock device, attach a note to this form indicating the procedure approved.   若特别的GSS电气工程授权修改一个现有的系统，以使工作得以执行，例如，关键的连锁装置的  移除、在此表格加注程序的批准 |  |
| 1. Verification of the above plan by another electrically authorized person, preferably not on site, for example a GSS electrical engineer.   其他电气授权人员对上述计划的确认，以不驻厂较佳，例如GSS电气工程师 |  |
| 1. De-energize the normal power supply in the sequence as outlined on the marked up single line diagram.   正常电源供应的断电，如单线图中标示出来的次序 |  |
|  | 1. Verify isolation by testing (test before touch). If this location is on the incoming side of the circuit breaker or bus, then Cat 4 or 5 PPE with voltage rated gloves and voltage rated tools shall be used.   藉由测试确认绝缘(在接触之前做测试)。若此位置在断路器或总线的入口侧，则应该使用第4类或第5类PPE |  |
| 1. Earth the bus to be worked on.   对在其上工作的总线接地 |  |

|  |  |
| --- | --- |
| **Appendix C2**  **附录C2** **This checklist defines the steps and actions required TO RESTORE The NORMAL ELECTRICAL SUPPLY TO THE LV BUS** 此检核表定义恢复正常的电源供应至LV总线所需的步骤以及行动 | |
| 1. Indicate on a copy of the relevant single line diagram, the sequence of the switching operation required to restore the system to normal operation.   在相关单线图的复本上指示将系统恢复至正常操作所需的切换操作次序 | Sign Off |
| 1. Remove the earthing conductors.   移除接地连接器 |  |
| 1. Restore to normal operating mode, any temporary system modifications authorized by GSS Electrical Engineering, for example; replacing keyed interlock devices, etc.   恢复至正常操作模式，任何由GSS电气工程所授权的临时系统修改，例如更换上锁的连锁装置等。 |  |
| 1. Restore normal power in the sequence as outlined on the marked up single line diagram, and verify correct operation (phase rotation etc).   依照单线图上标示出来的次序恢复正常的电力，并且确认正确操作(相位旋转等) |  |

**Appendix D1**

**附录D1**

|  |  |
| --- | --- |
| TEMPORARY Electrical POWER Supply Checklist 临时的电力供应检核表 | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | Facility :  设施 | Date 日期: | | | | | Plant :  工厂 |  | | | | | Switchroom :  开关室 |  | | | | | Single Line Diagram No.  单线图号 |  | Revision 修订版本: | |  | | Electrical Supervisor :  电气监督 |  |  |  | | | Checked :  检查 |  |  |  | | | Associated Permit No.  相关许可序号 |  | | | | | |
|  | This checklist defines the steps and actions required before the connection of a temporary electrical power supply to a permanent plant electrical installation. Due to the risk of back feed to equipment that is required to remain de-energized during maintenance outages, upgrades, etc a physical break in the electrical supply system is required. This physical break may be, for example withdrawing a withdrawable circuit breaker, removing bus links in a bus duct, removing fuses in a fused switch, removing cable terminations, etc. The opening of a non-withdrawable device such as a disconnect switch, molded case breaker, etc. is acceptable for this purpose, provided the device is lockable in the open position and approved by GSS Electrical Engineering. Consideration shall be given to ensure correct operation of electrical protective devices can be achieved from the temporary supply source. Ensure current protection between the temporary source and temporary load exists. When each action has been performed sign off the appropriate box.  此检查表定义在临时电力供应连接到永久性工厂电站前的步骤和举措。由于回馈给总线的风险，在维修和电器升级改造时，供电系统中的实体断电器是必需的。此实体断路器可能为例如抽出一种可抽出的断路器、在母线导通线路上移除母线连接、在保险断路器上移除保险丝、移除电缆端子等。非可抽出式装置的开路，例如：断路切换器、无熔线断路器等，对于此用途也是可以接受的，假如该装置可锁定在开路位置并且**由GSS电气工程核准**。应考虑确保正确操作临时电源的电力保护装置。确保临时电源和负荷间的电流保护存在。每项步骤完成后在相应的空格中签名。 | |
|  | The following list defines the actions and steps to be taken:  以下列表定义必须采取的行动与步骤：  Installation of Temporary Power Supply or Generator  临时电源供应或发电机的安装 | |
|  | Sign Off |
| 1. Indicate on a copy of the relevant single line diagram the loads that will be fed from the temporary power supply.   在相关单线图的复本上指示将自临时电源供应的负载 |  |
| 1. Indicate on a copy of the relevant single line diagram the following information:   在相关单线图的复本上指示以下信息   1. The physical isolation position(s).   实体隔绝的位置   1. The temporary supply connection point.   临时的供应连接点   1. The points required to verify isolation by voltage testing which must be immediately upstream of the physical isolation position. The voltage verification of isolation shall not be upstream of an open device, see examples in Appendix E, unless using a molded case breaker.   在实体断路位置上游处做的电压测试确认隔绝所需要的重点   1. The normal de-energizing position or device.   正常的断电未制或装置   1. Indicate earthing location when permanent connections are to be removed.   当固定连接要移除时指出接地位置 |  |
| 1. Indicate on a copy of the relevant single line diagram, the sequence of the switching operation required to isolate the normal power supply.   在相关单线图的复本上指示隔绝正常电源供应所需的切换操作次序 |  |
| d) If specific GSS Electrical Engineering authorization is given to modify an existing system to allow the temporary electrical power supply, for example; removal of a key interlock device, attach a note to this form indicating the procedure approved.  若特别 若特别的GSS电气工程授权修改一个现有的系统，以使工作得以执行，例如，关键的连锁装置的移除、在此表格加注程序的批准 |  |
| 1. Verification of the above plan by another electrically authorized person, preferably not on site, for example a GSS electrical engineer.   其他电气授权人员对上述计划的确认，以不驻厂较佳，例如GSS电气工程师 |  |
| 1. Ensure that the temporary power supply or generator is isolated, locked off, tagged out and if it is a generator, ensure that the engine is disabled by removing the starter battery, the starter motor lead or by some other means.   确认临时电源供应或发电机已被隔绝、上锁、挂签，并且若是发电机，确认引擎已藉由移除  启动器电池、启动电动机导线或其他装置而失效。 |  |

|  |  |
| --- | --- |
|  | Sign Off |
| 1. De-energize the normal power supply in the sequence as outlined on the marked up single line diagram.   如单线图上标示出来的次序将正常的电源供应断电 |  |
|  | 1. Verify isolation by testing (test before touch). If this location is on the incoming side of the circuit breaker or bus, then Cat 4 or 5 PPE with voltage rated gloves and voltage rated tools shall be used   藉由测试确认隔绝(接触前测试)。若回路断路器或总线进端隔离，参考第4或第5分类PPE，使用电压等级防护手套和工具 |  |
| 1. Earth the bus or sections as indicated on the single line diagram to permit removal of permanent connections.   如单线图上标示出来将总线或段接地以方便固定连接的移除 |  |
| 1. Perform the physical isolation at the points defined on the single line diagram (remove bus links, cables, etc.)   在单线图上定义的点上进行实体隔绝(移除总线连接、电线等) |  |
| 1. Ensure that the temporary power supply or generator neutral point is connected to the plant earthing system, connect generator cables, replace panels, barrier off the area and perform any other steps necessary to prevent personnel from contact with temporary wiring and or connections.   确认临时电源供应或发电机中性点连接至工厂接地系统、连接发电机电线、更换电盘、以阻障隔开此区域并进行预防人员接触临时电线及/或连接所需的其他步骤 |  |
| 1. Remove tags and/or locks from the temporary power supply and if it is a generator enable the engine, start the generator, then energize the equipment or load which is to be supplied from the temporary power supply.   自临时电源供应器移除标签及/或锁，并且若为发电机则使引擎复归、起动发电机，接下来将设备通电或装载来自临时电源供应器的电力 |  |
| 1. Verify isolation once again by voltage testing as indicated on the single line diagram.   藉由电压测试再次确认绝缘，如单线图上的指示 |  |
| 1. If applicable verify phase rotation is correct and change if necessary.   若可行则确认相位的旋转是否正确并且依需要进行变更 |  |
| **Appendix D2**  **附录D2** **This checklist defines the steps and actions required TO RESTORE The NORMAL ELECTRICAL SUPPLY** 此检核表定义恢复正常的电源供应所需的步骤与行动 | |
| 1. Indicate on a copy of the relevant single line, the sequence of the switching operation required to restore the system to normal operation.   在相关单线图的复本上指示将系统恢复至正常操作所需的切换操作次序 | Sign Off |
| 1. Shutdown temporary power supply or generator.   关闭临时电力供应或发电机。 |  |
| 1. Ensure that the temporary power supply is isolated, locked off, tagged out and if it is a generator ensure that the engine is disabled by removing the starter battery, the starter motor lead or by some other means.   临时电源供应或发电机已被隔绝、上锁、挂签，并且若是发电机，确认引擎已藉由移除启动器电池、启动电动机导线或其他装置而失效。 |  |
| 1. Test to ensure circuit is de-energized at the point of temporary power supply or generator connection, as defined on single line diagram (test before touch).   测试以确认线路已经在临时电源或发电机接点的位置上断电，如单线图上的定义(接触前测试)。 |  |
| 1. Verify normal supply is still de-energized at isolation point defined on single line diagram.   确认正常电源仍然在单线图所定义的隔绝点上断电。 |  |
| 1. Remove temporary wiring and replace or reconnect the physical isolation to the original status, and remove earthing conductors if applied.   移除临时电线并且更换或重新连接实体隔绝点回复至原始状态，并且若适用的话，移除接地连接 |  |
| 1. Restore to normal operating mode, any temporary system modifications authorized by GSS Electrical Engineering, for example; replacing keyed interlock devices, etc.   恢复至正常操作模式，任何由GSS电气工程所授权的临时系统修改，例如更换上锁的连锁装置等。 |  |
| 1. Restore normal power in the sequence as outlined on the marked up single line diagram, and verify correct operation (phase rotation etc) of loads which have been connected to the temporary supply.   依照单线图上标示出来的次序恢复正常的电力，并且确认正确操作(相位旋转等) |  |

**Appendix E**

**附录E**

symbology1