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北极星
NSTAR®

E-9188G3型 超越激光焊、高效精密冷焊机

使用说明书

乐清市北极星电子有限公司
YUEQINGSHI NORTH STARELECTRON CO.,LTD

尊敬的用户：您好！

首先感谢您购买公司产品，公司全体员工以真诚的态度对待每一位用户，我们衷心的希望您在使用本公司的产品以后，能为您带来工作的便利、降低费用、节约成本，提高您的产品市场竞争力，希望您能提出宝贵的意见和建议。

已通过ISO9001:2000国际质量管理体系认证

目　　录

一、概述 …… 1
二、性能指标 …… 1
三、操作面板与安装示意图 …… 1
四、使用 …… 2
五、工艺技巧 …… 3-4
六、氮化工件的焊接 …… 4
七、不锈钢薄板的焊接 …… 5
八、铜、铝件的焊接 …… 5
九、常见问题 …… 6
十、标准装箱清单 …… 6

一、概述

本机工作原理：本机采用大功率逆变电源技术(AC-DC-AC-DC),把市电转换成低电压，大电流的直流电源，使其达到我们所需要的焊接电源条件，再通过微电脑技术，对焊接的时间进行精确控制，使转换出来的电能在瞬间过脉冲电弧的形式释放于钨极与工件之间，温度极高的电弧使金属材料组成的工件和焊丝迅速熔化而熔接在一起，达到焊补目的。

这种焊补方法的特点是：时间很短，发热量很小。本焊机可在几十毫秒内完成焊丝和工件熔接过程，相对于普通焊机(大于几秒钟)来说，传导到工件的热量少得多。所以就工件基体来说，发热较少，焊点以外的材料温升小，不会产生退火、变色现象。由于每个焊接脉冲产生的熔池体积小于2mm³，其形成的应力也较小。虽然一项焊补需要很多个熔池组合起来，但由于焊点的应力方向分散，工件受到的集中应力较小，所以焊补后工件变形较小。

由于本机的输出脉冲能量非常集中，因此，普通焊机很难处理的铜和铝也能焊补。

E-9188G3型是我公司自主开发G型之后又开发了的最新金属修补焊机，它具有以下优点：

1.熔接强度高：完全冶金熔接，修补处可铣、锉等后期加工。

2.修补精度高：可使用圆丝补材进行修补，不会失去原基准面，多余焊料少，后期整形容易。最小修补量为0.05mm（使用直径0.05mm的补材）。

3.修补速度快：最快修补量可达100mm²/min。

4.基材损伤小：发热点小，不会造成基材退火变形。

5.功率分配合理：使用微电脑芯片控制，各种不同直径的材料都能获得最佳功率。

6.电压适应范围大：使用开关电源，当电压变化在±20%的范围内波动时，机器仍能保证正常工作，并维持稳定的输出功率。

7.电连接方便：配有快速接头连接器，可很方便地连接安装。

8.携带方便：整机体积小，(375×150×230)mm³，重量轻9kg。

二、性能指标

可焊补材料：除锌、锡等熔点很低的材料和硬质合金外，各种金属材料(包括铜和铝)制成的工件均可修补。

可焊补项目：1.设备和模具在使用过程中产生的局部磨损。
2.制造过程中加工缺陷，如砂眼气孔、尺寸超差、棱角损伤、氩焊不足等。
3.型腔的锈蚀斑等凹陷。

使用电源：单相220V±20% 50Hz
功率消耗：10-3000W
瞬时最大功率：大于40KW
功率模式：输出电流连续可调；输出脉冲频率1～10HZ可调；输出占空比1～99可调。
主机体积：375×150×230mm³
主机重量：9Kg

三、操作面板与安装示意图

前面板部分：
安装前面板（如左图所示）
1、将焊枪连接螺母拧紧在接线柱(6)上；
2、将接地电缆的快速接头顺时针拧紧在连接座上(14)
3、将脚踏/手控开关连接线插入“控制”插座(13)，插入时用手握住插头后部；使插头上的凹槽对准插座的凸筋；轻轻推入即会自动锁住。如果要拔出插头时，用手握住插头外壳往外拉出即可。

①频率指示窗
②频率调节键
③单点模式指示
④延气选择开关
⑤电流大小调节旋钮
⑥焊枪连接端
⑦占空比指示窗
⑧占空比调节键
⑨连续模式指示
⑩模式选择按键
⑪工作电源指示
⑫总电源开关
⑬控制开关插座
⑭接地钳连接端

后面板部分：

1、插上氩气管

2、将插头插在220V 50Hz的单相插座上，插座的接地线必须可靠接地。

四、使用

安全准备：

在进行焊接时，有强烈的电弧闪光和高温飞溅物，会灼伤眼睛和皮肤。必须戴专用防护面具！即使戴面具后电弧闪光仍会刺激眼睛，影响眼睛健康，所以脚踩开关时要眨一下眼睛避开闪光。

1、电极的准备及安装：电极采用钨铈电极(一般的焊接材料商店有售)，直径用2mm和1.5mm两种。一般棱角部分和平面的少量缺损用1.5mm的电极。焊补量较大时，因此时焊接电流较大，用直径2mm的电极。电极需在砂轮机上磨尖，磨尖的剖面角度在20°-25°为佳。随机备有两种夹头，选择对应将电极夹紧在焊把上。电极露出喷气口的长度在8mm左右为好。露出太长容易氩气保护不足，使焊点发黄或发黑。露出太短操作视线不好。

2、焊丝的选择：一般情况下，应选择与母材相同的焊丝。如果不能完全相同，至少要选择性质相近的焊丝。某些含碳量高的材料，如铸铁件，在修补时，会遇到修补点变硬的问题。此时应尽量选用细焊丝和小功率，以减小热效应。

3、机器各按键及功能说明：

1)频率调节：频率调节范围为1～10Hz，该值在连续工作模式时，是每秒钟焊接的次数；在单点工作模式时，可配全占空比调节以控制每点焊接时间长短。该功能主要用于自动焊接时的调节。

2)占空比调节：占空比调节范围为1～99%，占空比也就是百分比，在不同的频率下，同样占空比，所工作的时间是不同的。如：当频率为1Hz（1s/1Hz=1000ms），占空比为50%时，则每点所焊接的时间约为500ms；当频率为10Hz(1s/10Hz=100ms),占空比为80%时，则每点所焊接的时间约为80ms。在这些频率参数和占空比参数下，焊接时间会相同，主要是单点时，连续是则，自动焊接的频率（速度）会有区别。

3)电流调节：电流是无级可调的，应根据焊接的情况不同而调节相应的电流大小。

4)模式选择：

1、共3种模式，单点模式、连续模式、高级氩弧焊模式，三种工作模式轮流切换。

2、每按一次模式选择按键，机器切换一种工作模式，且相应的工作模式指示灯会显示相应的工作状态，氩焊功能，是二灯全灭，但示值窗口会显示“--”，意为不可调节。

3、存储功能：若所按模式选择键的时间超过1秒，则当前工作状态，及所设定参数会存储起来，下次开机启动时，就会显示所存储值，该功能主要用于常用或习惯参数的保存，设定好下次开机不用调节就可直接使用。

5)各模式功能说明：

1、单点模式：当每脚踏一次开关，本机只会输出一个所设定好的单点脉冲。可根据情况调整单点工作的输出时间，可调节频率和占空比来调节输出的电流的时间，再调节电流大小，使其达到所焊接的最佳效果。

2、连续模式：当每脚踏一次开关，本机会输出一个与单点焊接时间，电流大小相同的脉冲，每秒输出的次数由频率调节来进行调整。此模式一般用于自动化焊接，或在熟悉焊接技巧的情况下进行快速连续焊接。

3、氩焊模式：当每脚踏一次开关，本机会一直有焊接输出，相当于另外增加了一台氩弧焊的功能。

6)延气选择：延气选择有二档，一档是2.5S，另一档是5S，当开关选择2.5S时，在焊接结束后枪口会有2.5S的保护气体继续流出，此时焊枪请不要移开，要对准焊接的部位进行气体保护，使其不氧化或变色，当延气结束后再移开焊枪。选择5S时，则气体保护的时间会达到5S。

注：当在高级氩焊模式下，单点，连续指示灯灭，频率和占空比调节窗会显示“- -”，不可调节，此模式下只有电流大小调节功能有效。

注：后续版本的产品功能可能会有所区别，本公司保留有对其功能说明的权利。

4、接地：将接地铁钳在工件上使连接良好。

5、开始修补：

1)工件表面的铁锈、油污要清理干净。

2)打开焊机电源

3)根据实际情况，选择模式、频率焊接电流和占空比

4)打开氩气瓶阀门，调节节流阀使其工作在合适流量下(注意：需踩住脚踏开关并同时调节，一般情况在1-5L/min之间比较适合)；

5）将钨铈针悬于合适位置(详见第五章第四条)，踩脚踏(或手控)开关，即可产生一个焊点。连续重复该动作可产生一条具有一定高度和宽度的焊线。如果您的操作已经非常熟练，或进行自动化操作，可将面板上“模式选择”按键选择在“连续”状态，踩住脚踏开关(或按住手动开关)不放，此时机器连续输出脉冲，产生连续的焊点。

6）停止工作时，需关闭焊机电源，关闭氩气瓶阀门。注：将焊机断电或关闭后，机器面板上的显示仍然会持续一段时间，直至余电释放完毕。这是正常现象。

注：若焊机在长时间的焊接后，会进入保护状态而中止工作，则本机处于保护状态，此时不用关机，让其静置一段时间后，机器会由于风冷或自然冷却，温度降到所设定值后本机可再继续工作。输入电源的线缆长时间在氩焊模式工作时应选择大于3mm²电缆，输入插头供电应大于15A。在机器工作时请将机壳用导电面积大于6mm²的导线可靠接地。

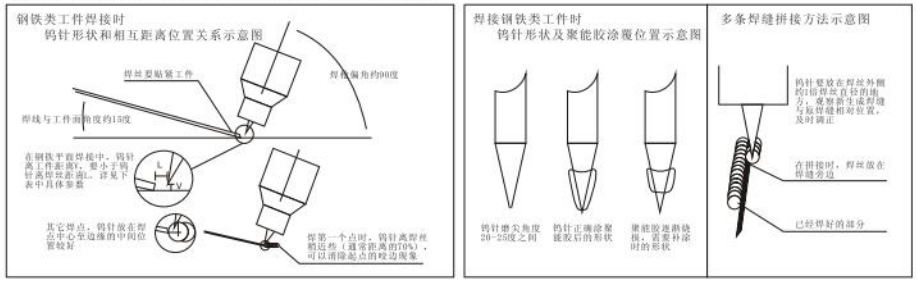
五、工艺技巧

一、钢铁类工件焊补

1、平面焊补：

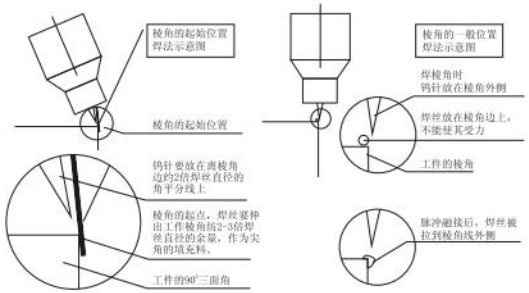
这里指的平面焊补包括平面及类似平面的圆弧。焊接时电弧加热的重点是工件，只有工件熔化时焊丝才能过渡到工件形成合格的焊点。实际操作中钨针离工件的距离要小于钨针离焊丝距离。具体见示意图，焊接时的相关参数见下页表格。

注：下表中的数据是钨针针尖完好或刚涂了聚能胶的条件下比较适中的选择。同等条件下脉冲电流增加，产生的焊点高度减小但面积增大，反之则高度增加面积减小，当钨针不尖和聚能胶烧损时，需加大脉冲电流弥补。该表不适合棱角和内角的焊接。



2、棱角的焊接

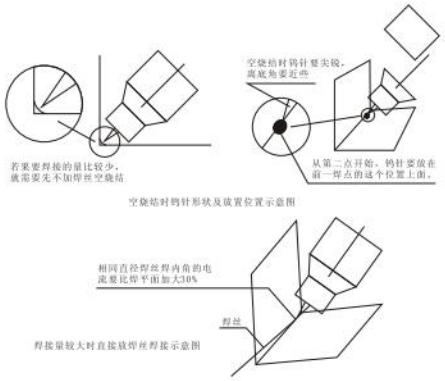
工件的棱角在焊接时的起点和结尾处容易产生“咬边”的现象。棱角位置的特点是工件基体散热较小，在焊接时电弧加热的重点也与平面焊接有区别。在棱角部位电弧加温的中心可以是稍偏向焊丝，利用高温的焊丝液来熔化工件尖锐的棱角，使两者融合在一起，避免电弧直接烧蚀工件产生“咬边”。参见右图示意。

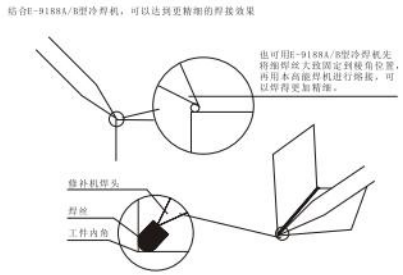


3、内角的焊接

我们这里指的内角是工件中两面形成的夹角等于或小于90度的情形。由于电弧放电走最短路径的特点，用常规的焊接方法焊接，常常会有焊不到底角部位的现象，特别是少量焊接时问题更突出。此时应将钨针磨得很尖(<20°)，不放焊丝，钨针在角中心线的方向接近底角，在针尖与底角、两边的距离很小(参考下表)，使两边的被熔化金属拉到中间位置形成一个焊点，如果出现不能在中间产生焊点的情况，可将钨针移到更接近底角的位置再试一次，或增加焊接电流再试，直至中间产生焊点为止。接下来可每次将钨针中心移至焊点中心与焊点边缘1/2的位置，重复熔接，使底角的直角边变成圆弧边。以后的焊接就比较容易了，可参考“平面焊接时的相关参数表”数据加30%左右脉冲电流值即可。

在焊补三面棱角时，一般需要首先将内角的修补量补足，然后再焊补外侧的平面。





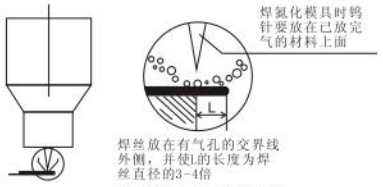
六、氮化工件的焊接

氮化工件由于在氮化工艺时大量氮气分子渗入工件表面，当焊接时的高温使氮气快速溢出，导致熔池出现大量气孔，有时会将熔化的金属喷溅到钨极上，影响焊接的进行。所以要得到合格的焊接表面，首先要解决排除氮气的问题，通常我们用反复电弧烧熔的方法排气，一般要进行5-10次的电弧烧熔才能将气体排完，熔池的凝固表面从开始时大量针状孔到中间部分逐渐光滑时(外圈会一直有针孔)，说明气体以基本排完，如果需焊接的面积较大，建议先将氮化层磨掉后再进行焊接，焊接后焊点与氮化层的交界处已产生一条有很多针眼的接缝，需要用特殊方法焊接才能消除。具体操作方是：将钨针(要求磨尖或涂好聚能胶)对准已排除气体的部位，离交界线0.4mm-0.6mm，针尖高度0.4mm，焊丝放在交界线外侧。使焊点的熔接温度刚好熔化焊丝覆盖住交界缝，又没有使边缘的氮化层产生新的针眼。如果焊接的是一个小圈点像上面的操作一般需要3-4次才能覆盖四周，如果进行过程中焊点的高度大于0.5mm，就需要将它磨低至0.2mm左右再行焊接才能较容易地消除交界缝的针眼，用薄焊片可以避免焊点高度太高的麻烦。

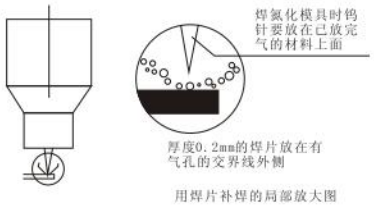
氮化表面在第一次放电熔接后会产生密集气孔

经过3-5次放电熔接后气孔明显减少

经过8-10次放电熔接后只剩下边缘有气孔，就可以加焊丝熔补



用焊丝补焊的局部放大图



用焊片补焊的局部放大图

七、不锈钢薄板的焊接

一、拼接

拼接是指将两片厚度相同的板材拼接在一起变成一张；或者将卷成圆形的板材焊成一个整体。做拼接焊时，备件的拼合缝要小并且平整。

检验焊接功率是否合适的标准：

看焊点背面的缝是否熔合。可先用两片厚度与待焊件一致的试样片进行试焊。焊接后折一下，看是否还有分开的细缝。若还有缝的话，就增大焊接电流和时间；也可只增加时间，使时间的数值大于电流的数值，电流的数值越小，工件材料被拉过来的越少。

二、板材延长

有时薄板末端会出现少许尺寸不足，此时可以加焊一段材料上去，以延长板材。

八、铜、铝件的焊接

1)紫铜件的焊补：

紫铜熔点较低但导热性能非常好，焊接中要求功率大，焊接电流和焊接时间比焊接钢铁时要大，特别是焊接时间相对要更长，钨针要磨得钝一些(直径1mm处的角度在90度左右)。钨针磨钝有两个作用：一是防止电流太集中使深化的铜料飞溅出去产生小坑，二是防止钨针粘住时折断而污染焊点。焊接时钨针、焊丝、工件三者距离要很近，差不多是碰在一起的。钨针经常会与焊点粘连，只要钨针不扳断就不影响焊点质量。焊接点的紫铜材质比较松，焊接后要用锤子敲击使其密实才能使用。

注：钨针端部全部磨90度角，没有注明尺寸的端部直径都是1mm,钨针与工件的距离可以和钨针与焊丝的距离一样。该表数据适合厚度大于10mm的大件，工件厚度每减小1mm脉冲电流和脉冲时间各减小5%,补棱角时在以上基础上脉冲电流取50%，脉冲时间可不变。焊紫铜时钨针不要涂聚能胶。

2)黄铜件的焊补：

黄铜由于含锌量较多，锌的燃点很低很容易燃烧挥发，所以黄铜件的修补是较困难的，焊接电流的选择相对于钢铁要小一些，焊接时间要略长一些。焊丝直径取1mm以下的较好，钨极端部可略钝一些。

注：钨针端部全部磨90^0角，没有注明尺寸的端部直径是1mm，钨针与工件的距离可以和钨针与焊丝的距离一样。焊棱角时脉冲电流取70%，脉冲时间可不变。焊黄铜时钨针不要涂聚能胶。

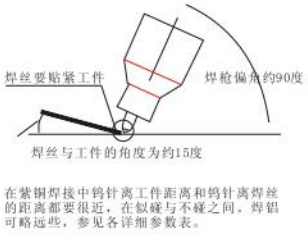
3)青铜件的焊补：

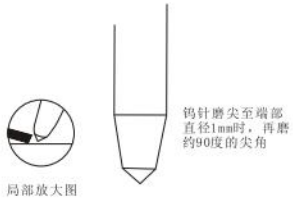
青铜件焊接较容易操作，可参考钢铁的焊补方法进行。

4)铝件的焊补

铝具有导热性好，燃点较低的特点。铝件焊补方法可参照紫铜的焊接方法，一般采用直径1mm以下的焊丝，操作性较好。

注：钨针端部全部磨90^0角，没有注明尺寸的端部直径是1mm，钨针与工件的距离可以和钨针与焊丝的距离一样。焊棱角时脉冲电流取70%，脉冲时间可不变。焊铝时钨针不要涂聚能胶。





九、常见问题

常见现象	原因	解决方法
焊丝起珠，未能融化到工件上！	1、钨铈针离工件距离太远，离焊丝距离太近！	把钨铈针放在焊丝的延长线0.3-1.0mm位置，同时保持离工件在0.2-0.7mm的高度。(详见第四页钨铈针高度章节)踩脚踏开关时不要因为脚的踩动而让钨针发生偏移。
	2、机器的输出功率设定偏小	调整机器的占空比和脉冲电流来增加机器的输出功率。
	3、焊头过粗，功率分散！	磨尖焊头，同时涂上聚能胶。
	4、焊枪太斜，导致电直接放到焊丝上！	尽量使焊枪与工件垂直，同时保持焊丝与焊枪成90度角比较合适。
	5、焊丝末端没接触到工件！	保证焊丝末端和工件紧密接触，尤其是焊丝末端略有上翘时，应注意调整。
焊点发黑或发黄！	1、钨铈针露出部分太长，导致氩气保护不足！	重新调整钨铈针，让露出部分保持在8mm左右
	2、机器输出功率设定过大	调整机器的脉冲时间和脉冲电流。
	3、工件表面脏！	清除工件表面的脏物。
	4、氩气没开或已没有氩气！	开起并确保有氩气。
机器有拉弧声，但不能焊接！	1、按地电缆没有与工件连接！	把接地电缆可靠连接到工件。
	2、焊枪离焊接处太远	把焊枪针尖移到离焊接处约2～4mm处，针尖、焊丝、焊接点、三点应对准。
焊丝起珠后就焊不上了！	1、焊丝起珠部分的直径比原先的大，导致焊接功率不够！	剪掉起珠部分；或把钨铈针放得比标准位置低，使其离工件和焊丝都更近。为了确保焊接质量和美观度，建议剪掉起珠部分。
钨针经常与工件粘住！	1、离工件的距离太近！	钨铈针与工件的距离放远一些！
	2、焊丝拉过来材料太多！	把焊丝放远一些，或者直接剪掉焊丝起珠部分(如果有起珠)

十、标准装箱清单

名称	单位	数量
主机	台	1
焊枪	把	1
接电电缆(带钳)	条	1
自动液晶变光面罩	顶	1
LED工作灯	只	1
气管	根	1
脚踏开关	只	1
钨铈针	根	6
气保焊丝：φ1.6 mm	根	10
φ1.2 mm	根	10
φ1.0 mm	根	30
φ0.8 mm	根	50
φ0.6 mm	根	10

**以上附件，本厂长期供应。

**本机自售出之日起对主机保修壹年。共它附件属易损部件，不在保修范围之内，敬请凉解。

产品合格证

品 名	
型 号	
出厂编号	
检验员	
备注	检验合格、准于出厂

产品保修卡

客户姓名		联系电话	
详细地址			
产品型号		出厂编号	
购机日期		发票号码	
购机地点			
经销商			
故障发生日期			
故障现象			
维修记录			

产品保修细则

1、自购买之日起，本公司负责主机保修一年，对元件正常的损坏，本公司负责免费修理。

2、保修期内因不正当使用或自行拆卸导致损坏，如需修理，则要适当收取修理费和零件费。

3、保修期内，如产品有任何质量问题，可凭保修卡或购机发票到本公司或就近的分公司维修。

4、保修卡请妥善保管，并在保修时出示本卡和购机票据，如遗失，则本公司不负责免费维修。

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北极星

NSTAR

E-9188G3-type Ultra-laser Welding and High-performance Precise Cold Welding Machine

User's Manual

YUEQINGSHI NORTH STARELECTRON CO.,LTD

Dear Users: How are you!

Congratulations on your purchase of the production of our company! Our company treats every customer in a faith attitude and we sincerely hope that our products can bring you conveniences, lower and reduce costs, improve your product market competitiveness after using our products. We hope your can put forward valuable comments and suggestions.

Our company has passed ISO9001: 2000 international quality management system certification.

Contents

I. Overview ····· 1

II. Performance and indicators ····· 1

III. Operation panel and installation diagram ····· 1

IV. Use ····· 2

V. Process ····· 3-4

VI. Welding of nitrided workpiece ····· 4

VII. Welding of stainless steel sheet ····· 5

VIII. Welding of copper and aluminum parts ····· 5

IX. Frequently asked questions ····· 6

X. Standard packing list ····· 6

I. Overview

The working principle of this machine: It employs the large-power inversion power supply technology (AC-DC-AC-DC), can convert the utility power into the DC power of low voltage and large current, to reach the aim of required welding power supply, then, it uses the microcomputer technology to perform the accurate control of the welding time, so as to release the converted energy between the tungsten electrode and work piece in the form of instantaneous over-pulse arc, and, the arc of ultra-high temperature can make the work piece made of metal and welding wire fuse and splice together, to meet the requirements of welding repair.

This welding repair method is featured by short period and less heat. This welding machine can complete the fuse process of the welding wires and workpieces within tens of milliseconds. Compared with ordinary welding machine (more than a few seconds), there is much less heat conduction to the workpieces, therefore, for the matrix of the workpiece, there is less heat, and lower temperature rise beyond the welding spots, without annealing and discoloration. As the volume of molten pool generate by each welding pulse is less than $2mm^3$, its formed stress is relatively smaller. Although a welding repair requires the combination of a number of molten pools, the stress directions of welding spots scatters, the concentrated stress of the workpiece is relatively smaller, therefore, the workpiece deformation is smaller after welding repair.

Since the output pulse energy of this machine is concentrated, therefore, this machine can carry out copper and aluminum welding repairs, which are difficult for ordinary welding machines.

1. High weld strength: Full metallurgical fuse, the repairing places can be subject to milling and filing and other post-processing.
2. High repair precision. Round wires can be used to repair, without lose the original base level, less redundant solders, and easy for post-phase shaping. The minimum repair amount is 0.05mm (filling material of 0.05m in diameter is used).
3. fast repair speed: the fastest repair amount is up to $100mm^2$ / min.
4. Less damage to base materials: small hot spots, without causing annealing and deformation of base materials.
5. Reasonable distribution of power: micro-computer chip control is adopted, and various materials of different diameters can obtain the best power.
6. Large adaptive range of voltage: the switching power supply is used. When the voltage changes fluctuate within the range of ±20%, this machine can work in normal state and maintain a stable output power.
7. Convenient for electricity connection: with quick connector, it is very convenient for connection and installation.
8. Easy to carry: small size of the whole machine: $(380\times150\times200)mm^3$, light weight: 9kg.

II. Performance and indicators

Welding materials: the workpieces made of various metal materials（including copper and aluminum） can be repaired other than the materials and hard alloys of low melting points such as zinc and tin, etc..

Applicable for: 1. Local wearing generated during the application process of equipments and moulds.
2. Processing defects in the manufacturing process, such as blowhole and pore, over size, corner damage, insufficient argon welding, and so on.
3. Corrosive pits of cavity and other defects.

Power: Single-phase 220V±20% 50Hz
Power consumption: 10 -1000W
Instantaneous maximum power: greater than 40KW
Power mode: Mode 1 - mode 5. Output current: 1 ~ 99 adjustable; output pulse time: 1 ~ 99, adjustable
Host size: $380\times150\times200mm^3$
Host weight: 9Kg

III. Operation panel and installation diagram

Front panel:
Installation of front panel (as shown in the left chart)
1. Screw up the connecting nut of the welding gun to the soldering terminal (10) tightly;
2. Screw up the quick coupling of the grounding cable to the connection base seat (5) clockwise tightly;
3. Insert the foot / hand control switch connecting cables to the "control" socket (9). When inserting, manually hold the back part of the plug, allowing the groove of the plug directly align with the convex rib of the socket; slightly push and automatically lock it. When the plug is required to pull out, hold the plug closure and pull it out.

① Frequency display window
② Frequency adjustment window
③ Single-point mode display
④ Gas-delay selecting switch
⑤ Current adjustment knob
⑥ Welding gun connection terminal
⑦ Duty ratio display window
⑧ Duty ratio adjustment key
⑨ Continuous mode display
⑩ Mode selection key
⑪ Working power display
⑫ Main power switch
⑬ Socket of control switch
⑭ Connection terminal of earthing tweezers

Part of back-panel:

1. Insert the argon (note: when pulling out the, hold on the plastic piece of the connecting part before pull it out!)
2. Insert the plug into a 220V 50Hz single-phase socket. The grounding lines of the sockets shall be reliably grounded.

IV. Use

Preparation for security:

During welding, strong arc flashes and high-temperature flying objects may burn your eyes and skin. It is necessary to wear special protective masks! Even after wearing a mask, the arc flash may irritate eyes and affect the eye health, therefore, when stepping on the foot switch, blink your eyes to avoid arc flashes.

1. Electrode preparation and installation: Cerium tungsten electrode is used (ordinary welding materials can be sold out in the stores), two types: 2mm and 1.5 mm in diameter. For small defects of common edges and plans, 1.5 mm of electrodes are used. In case of large welding part, the welding current is larger, the electrode with 2mm in diameter should be used. The electrodes should be ground sharply in the grinding machine, and the angle of the grinding profile should be at 20^0-25^0 preferably. There are two types of clamps standby, the appropriate electrodes should be clamped to the weld handle. The distance of the electrode exposed to the air exhaust opening should be about 8mm, if too long, the insufficient protection of argon gas may occur, to generate yellow or black welding spots. If too short, the operational vision is not good.

2. Welding wire selection: in general, the welding wires same as the parent metal should be selected. If not the same, at least the welding wires of similar nature should be selected. For some materials of high carbon content, such as cast iron pieces, when repairing, the hardness of the repairing spots may generate, at this time, try to use fine welding wires and small power, so as to reduce the thermal effect.

3、Key function：

1) Frequency adjustment: The frequency adjustment range is 1～10Hz，this value represents the times of welding every second in the mode of continuous operation; In the mode of single-point operation, the duty ratio adjustment is available for controlling the welding time of each spot. This function is mainly used for adjusting in automatic adjustment.

2)Duty ratio adjustment: Its adjustment range is 1～99%，it is also the percentage ratio; under the different frequency and same duty ratio, the working time is different. For example, when the frequency is 1Hz （1s/1Hz=1000ms）, and the duty ratio is 50%, the welding time of spot will be 500ms；and when the frequency is 10Hz(1s/10Hz=100ms), and the duty ratio is 80%, the welding time of spot is about 80ms. Because it is in the single-point mode, the welding time is the same under these frequency parameters and duty ratio parameters; if it is in the continuous mode, the automatic welding frequency (speed) is different.

3)Current adjustment: The current is stepless adjustable, so, it shall be adjusted according to the welding situation.

4)Mode selection:

1、Total three modes: single-point mode, continuous mode and high-class argon arc welding mode. These three working modes can be shifted in turn.

2、Once pressing the mode selection key, the machine can shift into one working mode, and the corresponding working mode lamp will display the relevant working state; as for the argon arc welding function, the two lamps go out, but the display window will show "--" that means the adjustment may not be performed.

3、Storage function: If pressing the mode selection key beyond 1s, the set parameters will be stored in the current working state, and, at the next startup, the machine will display the stored values. This function is used for storing the usual parameters, thus, the set parameters may be directly used without adjustment at the next startup.

5)Mode function instruction:

1、Single-point mode: Once stepping on the switch, this machine only outputs one set single-point pulse. The time for output current may be adjusted in accordance with the output time of single operation, adjustable frequency and duty ratio, then, the current may be adjusted, in order to get the best efficiency of welding.

2、Continuous mode: Once stepping on the switch, the machine will output the pulse with the same single welding time and current, the time of output every second is adjusted by regulating the frequency. This mode is used for the automatic welding operation or the fast continuous welding operation under being familiar with the welding.

3、Argon welding mode: Once stepping on the switch, the machine keeps the welding output, equal to adding the function of one argon arc welding.

6)Gas-delay selection: There are two gears for gas-delay selection, one gear is 2.5s, the other is 5s, when the switch is at the 2.5S gear, the gun will flow 2.S protection gas out after finishing the welding operation, at this moment, the welding gun shall not be moved, and the gas shall be protected by aiming at the welding part, to make sure there is no oxidation or color change; after finishing the gas display, the welding gun can be moved. When selecting the 5S gear, the time for gas protection will be 5s.

Note: In the mode of high-class argon welding mode, the single-point and continuous mode indicator lamp will go out, and the frequency and duty ratio adjustment window will show "- -" that means the adjustment is unavailable; in this mode, only the current adjustment is effective.

Note: As the functions of follow-up product may be different, the company reserves the right to explain the functions.

4、Earthing: Place the iron earthing pliers on the workpiece, to make them good connection.

5、Begin to repair：

1)The rust and oil stain on the workpiece shall be cleaned.

2)Switch on the welder power

3)In accordance with the actual situations, select the mode, frequency, welding current and duty ratio.

4)Open the valve of argon gas cylinder, adjust the throttle valve to work at the suitable flow (note: step on the pedal switch and adjust it, in general, the range of 1-5L/min is appropriate.

5)Rotate the tungsten-cerium pin to the suitable position (see the clause 4, chapter 5), step on the pedal switch (or manual switch), thus, the welding spot will be produced. If repeating this operation continuously, a welding wire of certain height and width may be provided. If you are very familiar with the operation and perform the automatic operation, you can select the " continuous state" by pressing the "Mode Selection key", and step on the pedal switch (or manual switch) with releasing, at this moment, the machine outputs the pulse continuously and produces the continuous welding spots.

6)If stopping the work, you shall turn off the power supply and close the valve of argon cylinder. Note: It is normal that the display of machine panel will keep some time, till the residual electricity is finished in releasing after cutting off the power of welding machine or turning off it。

Note: If the welding machine runs for long time, it will enter into the protection state and stops the operation, and this machine is in the protection state, it needn't to be tuned off, but it shall stand for a period of time, the temperature of machine will drop to the set value because of the air cooling or natural cooling, only thus, the machine can go on working. The cable of input power shall be larger than 3mm² in the argon welding mode, and the power supply of input socket shall be larger than 15A. When the machine works, its enclosure shall be earthed reliably with the conductor of 6mm² conductive area.

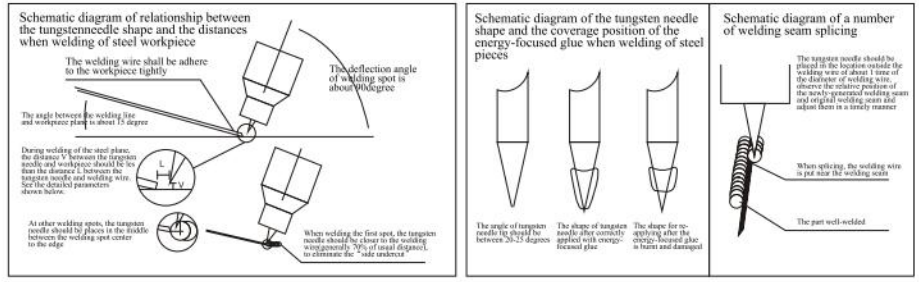
V. Technological skills

(I) repair welding of steel workpiece

1. Plane repair welding

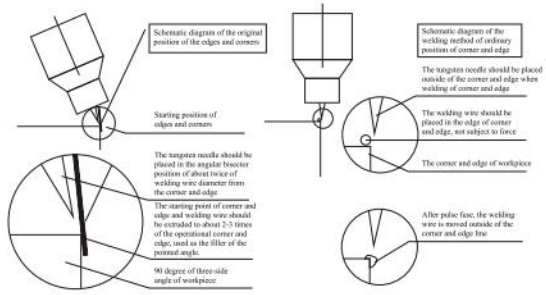
Plane repair welding should include the planes and arcs similar to the plane. When welding, the arc heating of the workpiece is very important. Only when the workpiece is molten, the welding wires can be transmitted to the workpiece to form qualified welding spots. During actual operation, the distance between the tungsten needle and the workpices shall be less than the distance between the tungsten needle and the welding wires. For details, refer to the diagram. The relevant parameters during the welding process see the table below.

Note: The data in the table below are appropriate when the tungsten needle tip is good or when the energy-focused glue is just painted. Under the same conditions, when the pulse current increases, the welding spot height reduces but the area increases, otherwise, the height increases and the area decreases. When the tungsten needle is not tip and the energy-focused glue is damaged, it is required to increase the pulse current makeup. The values set out in the following table are not applicable to the welding of the edge angle and interior angles.



2. Welding of edges and corners

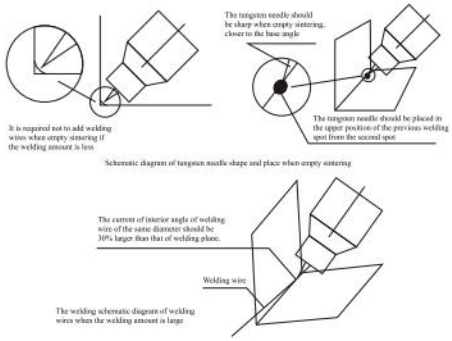
During the process of welding the edges and corners of workpiecses, "side undercut" may easily occur at the starting and ending positions. The edges and corners are characterized by less heat dissipation of the workpiece matrix, and during the welding process, the key positions of arc heating are different from plane welding. In the positions of edges and corners, the center of arc heating on the corners and edges can be slightly deflected towards to the welding wires. The high-temperature welding wire liquid is used to melt the sharp edges and corners of the workpiece to allow them to fuse together, so as to avoid the "side undercut" as a result of direct burning of electric arc. See the right schematic diagram.

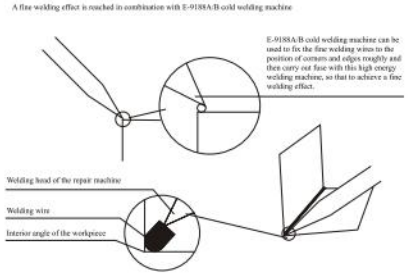


3. Welding of interior angle

The interior angles referred to herein is the angle of equal to or less than 90 degrees formed by the two sides of the workpice. Because the arc discharge is characterized by the shortest path, if welding is conducted in a conventional method, cases of no welding to the base angle will occur, particularly prominent for small amount of welding. At this time, the tungsten needle should be ground to very sharp (<), without welding wires. The direction of tungsten needle along the angle central line is close to the base angle, and the distance between the tip and base angle and the two sides(see the following table), to allow the molten metals on the both sides to be moved to the middle position to form a welding spot. If no welding spots generate in the middle position, move the tungsten needle to the position close to the base angle, and try once again, or increase the welding current and retest, until welding spots are generated in the middle part. And then move the tungsten needle center to the position of 1/2 distance between welding spot center and welding spot edge every time, fuse repeatedly, change the direct angle side of the base angle to round arc side, the welding will become easier. By referring to the data listed in the "relevant data for plane welding", add about 30% pulse current value.

When repair welding on the edges and corners on three sides, generally it is required to fully make up the repair of the interior angle , and then repair welding on the lateral plane.





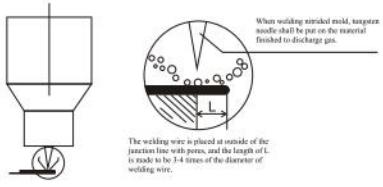
VI. Welding of nitrided workpiece

For nitrided workpiece, due to large amount of nitrogen molecules have infiltrated surface of workpieces as nitriding process, high temperature when welding make nitrogen gas overflow rapidly to cause that large amount of pores appear in molten pool, and molten metal may be splashed to the tungsten electrode sometimes, impacting welding operation. Therefore, in order to obtain qualified welding surface, the problem of eliminating nitrogen gas must be solved first. Usually method to eliminate nitrogen gas with electric arc fusing repeatedly is adopted by us. Generally, gas can be exhausted only with electric arc fusing repeatedly for 5-10 times. When coagulation surface of the molten pool changes from pinholes at beginning into gradual smooth in middle part of the pm (Pinhole will exist all the time at outer circle), it is indicated that gas has been emitted basically. If area to be welded is larger, it is recommended to grind away nitrided layer first before welding. A joint with many pinholes has been generated at the junction of between welding spot and nitrided layer, which may be removed with a special welding method. Specific operation method is: tungsten needle (required to grind sharp or coat with energy-focused glue) is made to align the position to eliminate gas, 0.4-0.6mm from the junction line. Height of needlepoint is 0.4mm. The welding wire is placed at outside of the junction line. Melting temperature at welding spot is made just to fuse the welding wire to cover the junction joint without causing nitrided layer on the edge to generate new pinholes. If what is to be welded is a small circle spot, place around will not be covered until the operation as above is conducted 3-4 times. If height of course spot welding during process is more than 0.5mm, it needs to be grind about as low as 0.2mm to allow that pinholes on junction can be eliminated more easy. The trouble of too high welding spot can be avoided with soldering flake.

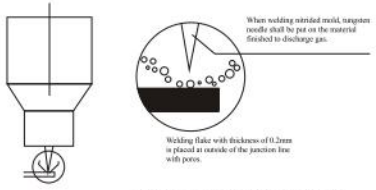
Intensive pores are generated on the nitrided surface after the first discharge for fusion welding.

Pores are significantly reduced after discharge for fusion welding 3-5 times.

Pores are only remained on edge after discharge for fusion welding 8-10 times,and then you can add welding wire to repair welding.



Local enlarged drawing for repair welding with welding wire.



Local enlarged drawing for repair welding with welding flake.

VII. Welding stainless steel sheet

A. Splicing

Splicing refers to that two plates with same thickness are jointed together into one, or a plate rolled into a cylinder is welded to a whole. Splicing joints of spare parts shall be small and flat as splicing welding.

Standard to test whether welding power is suitable:

To see whether seam in back of the welding spot is fused. Test welding may be conducted with two sample sheets with a thickness same as parts to be welded. Bend it to see whether there are any separated fine seams after welding. Increase welding current and time if there are still any seams; it can only to be done to increase time to allow time value to be greater than current value, the smaller current value, the less workpiece material pulled back.

B. Extension of plates

Sometimes, size at the end of a sheet will be some insufficient, a section of material can be welded to add up to extend the sheet. The power recommended is as follows:

VIII. Welding of copper and aluminum parts

1) Repair welding of red copper parts:

Melting point of red copper is very low but thermal conductivity is very good, which require large power during welding. Values of welding current and welding time shall be larger than those when welding steel and iron, especially welding time is relatively longer, and tungsten needle shall be grinded some blunt (angle at position of diameter lmm is about 90 degrees). Tungsten needle grinding blunt has two functions: first, to prevent the current from focusing too much to make deepening copper splash out to generate small pits; and the second is to prevent the tungsten needle from sticking causing breaking to pollute welding joints. When welding, tungsten needle, welding wire and workpiece are kept very little distance each other, almost touching together. Tungsten needle often sticks to the welding point. As long as the tungsten needle plate is not broken, the quality of welding point will not be impacted. Red copper material at welding point is very lose, which shall not be used until striking solid with a hammer after welding.

Note: All tips of tungsten needles shall be grinded to 90 degree angle. All tip diameters without size indicated are 1mm. The distance between tungsten needle and workpiece may be the same as the one between welding wire and tungsten needle. This data table applies to large parts with thickness of greater than 10mm. As long as thickness of the workpiece reduces 1mm, the pulse current and pulse time will also reduce 5% respectively. When mending edges and corners, current pulse is taken 50% basing on data above, and pulse time may be the same. Tungsten needle shall not be applied energy-focused glue when red copper welding.

2) Repair welding of brass parts:

Because zinc content in brass is much, and ignition point of zinc is very low being easy to ignite and volatilize, repair of the brass parts is more difficult. The option of welding current is smaller than the one of iron and steel, and welding time is a little longer. Diameter of welding wire is better to take less than 1mm. Tip of tungsten electrode can be a little blunt.

Note: All tips of tungsten needles shall be grinded to 90 degree angle. All tip diameters without size indicated are 1mm. The distance between tungsten needle and workpiece may be the same as the one between welding wire and tungsten needle. When welding edges and corners, current pulse is taken 70% basing on data above, and pulse time may be the same. Tungsten needle shall not be applied energy-focused glue when brass welding.

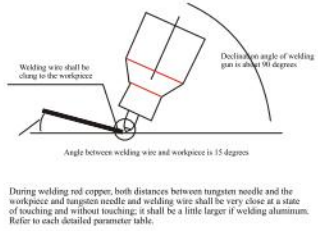
3) Repair welding of parts:

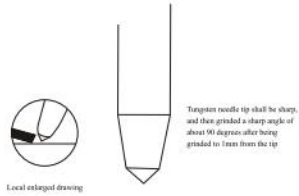
Welding of bronze parts is very easy to operate, which may be conducted referring to repair welding method of steel and iron.

4) Repair welding of aluminum parts

Aluminum has the features of good thermal conductivity and low ignition point. Repair welding method of aluminum parts may be conducted referring to the one of red copper, generally the welding wire with diameter less than 1mm has a better operability.

Note: All tips of tungsten needles shall be grinded to 90 degree angle. All tip diameters without size indicated are 1mm. The distance between tungsten needle and workpiece may be the same as the one between welding wire and tungsten needle. When welding edges and corners, current pulse is taken 70% basing on data above, and pulse time may be the same. Tungsten needle shall not be applied eawhen aluminum welding.





XI. Frequently asked questions

Common phenomenon	Reasons	Solution
The bead generating on welding wire rather than fusing on the workpiece!	1. Distance is too long from tungsten-cerium needle to the workpiece but too short to welding wire!	Put tungsten-cerium needle to the position at 0.3-1.0mm of extension of welding wire, meanwhile, the workpiece while is maintained at the height of 0.2-0.7mm. (See page4 for the section of height of tungsten-cerium needle) When step on foot pedal, do not let the tungsten needle deviation with stepping
	2. The output power of the machine is adjusted too small	Adjust pulse time and pulse current of the machine to increase the output power of the machine.
	3. Welding head is too thick causing power to bescattered!	Grind welding head sharp and apply energy-focused glue at the same time.
	4. Welding gun is too oblique, causing electricity to discharge directly on the welding wires!	Make welding gun be vertical to workpiece as far as possible, meanwhile it is appropriate to maintain 90-degree angle of welding gun to welding wire.
	5. The end of welding wire did not come into contact with workpiece!	Ensure the end of welding wire come into close contact with workpiece, especially to adjust when end of welding wire shows upwarp a little
Black or yellow on welding spot!	1. Exposing part of tungsten-cerium needle is too long causing inadequate protection of argon!	Re-adjust tungsten-cerium needle to allow exposing part to keep about 8mm
	2. Setting of output power of the machine is too large	Adjust pulse time and pulse current of the machine.
	3. The workpiece surface is dirty!	Remove dirt on surface of workpiece.
	4. Argon gas was not switched on or no argon gas!	Switch on and ensure there is argon gas.
There is arc discharge sound on the machine, but welding cannot be conducted!	1. The grounding cable was not connected to workpiece	Connect the grounding cable reliably to the workpiece.
	2.The welding gun is too far from the welding point	Move the pin tip of welding gun about 2～4mm from welding point, the pin tip, welding wire and welding point shall be aligned.
Welding cannot be conducted after beads generated on welding wire!	1. Diameter of generating bead part of welding wire is a large than the original one, causing welding power is inadequate!	Cut of the generating bead part; or put cerium-tungsten needle at the position lower than the standard one to make it be close from workpiece and the welding wire. In order to ensure the welding quality and aesthetic degree, it is recommended to cut off generating bead part.
Tungsten needle often sticks on workpiece!	1. Distance from workpiece is too short!	Distance between tungsten-cerium needle and the workpiece shall be set farther beyond!
	2. Material pulled back from welding wire is too much!	Put welding wire more farther, or cut off directly bead generating part of welding wire (if any beads)

X. Standard packing list

Name	Units	Amount
Mainframe	set	1
Welding gun	set	1
Wiring cable (with plier)	set	1
Automatic LCD shade-changing mask	set	1
LED working lamp	piece	1
Gas pipe	piece	1
foot pedal	set	4
Tungsten-cerium needle	piece	6
Gas shield welding wire: ϕ 1.6mm	piece	10
ϕ 1.2mm	piece	10
ϕ 1.0mm	piece	30
ϕ 0.8mm	piece	50
ϕ 0.6mm	piece	10

**Our factory supply accessories above long-term.
**The mainframe of the machine is committed to warranty for one year from the date of sales. Other accessories are not included in the scope of the warranty, please understand and forgive.

Product certificate

Product name	
Model	
Exwork serial number	
Inspector	
Remark	Only permit the qualified products leave factory, after examining

Maintenance card

Customer name		Telephone	
Detailed address			
Model		Exwork serial number	
The date of purchasing machine		Receipt serial number	
The place of buying machine			
Dealer			
The date of breakdown			
Breakdown			
Service record			

Regulation of maintenance:

1.The company is responsible for the main engine maintain in a year, in the warranty time we will change the normal damage part for the free.
2.In the warranty period because you can not use right,or disassemble voluntarily,which causes the damage, if need repair, we will account the repair expense and the components expense suitably.
3.In the warranty period, if the product has any quality question, you can repair the product in the company or the near subsidiary company service depend on the maintenance card or the receipt of buying machine.
4.Please take care of the maintenance card properly, when repair,please show this card and the receipt of buying machine, if lose them,the company will not be responsible for the free service.