

Technical Newsletter from
ADOR WELDING LIMITED
Formerly **Advani - Oerlikon Ltd.**

Product Update

RANGER 403 / RANGER 503

GMAW PROCESS FOR ALUMINIUM WELDING

An Overview

Aluminum and its alloys can be welded by MMAW, TIG as well as MIG welding. Choice of process is decided by technical and economical factors. Welding of aluminum by Gas Metal Arc Welding for aluminium is very critical and requires special attention for wire feeding. Application of MIG welding is in all types of aluminum fabrication structures. To understand MIG welding with aluminum electrode we must study properties of aluminum and complete wire feeding system along with its effect on wire feeding.

Aluminum is a reactive metal and forms an oxide film on being exposed. It is important that aluminum oxide film is removed before commencing welding, preferably with a stainless steel wire brush.

ATTRIBUTES	MILD STEEL	ALUMINIUM	SIGNIFICANCE
Density gms/cc	7.85	2.7	Al is approximately 3 times lighter than steel
Thermal conductivity	26 to 37.5	136	Al conducts heat 5 times faster than steel wire
Melting temperature °F/C	2550 1539	1220 660	Al melts at lower temperature



- Most reliable and dependable thyristor based power source for high quality MIG/MAG semiautomatic manual and semiautomatic mechanised welding applications
- Hexa phase, full wave full control bridge rectification circuit reduces

Young's modulus Gpa, (Giga pascal)	210	70	Al is 3 times more ductile. It is a measure of stiffness. So feeding of Al wire is difficult as its columnar strength is low.
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Some aluminum electrode wire specifications are as follows.
(Reference from data sheets.)

ER 4043:

- Silicon content: 5 %
- Tensile strength: 29000 psi
- Good puddle control
- Good bead appearance

ER 5356:

- Magnesium content: 5 %
- Tensile strength: 38000 psi
- Good puddle control
- It offers corrosion resistance when exposed to salt water.
- Feeding is better than ER 4043 due to high columnar strength.

To study welding procedure with Al electrode we will study complete wire feeding system and its set up. Wire feeding system consists of following components:

- wire spool
- drive rolls
- torch
- liner
- contact tip

WIRE SPOOL:

Normally diameter of spool is 300 mm and weight of complete Al electrode spool is around 6.5 Kg. There is brake setting provided on wire feeder hub. The brake setting of spool should be such that, while stopping spool should not be free wheeling as well as it should not be too tight. If brake is loose then wire will come out and tangle, if brake is too tight wire may slip on roller and there will be extra load on wire feed motor.

ripple in the welding output -
resulting spatterfree welding

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ALBOND 5 Si



- It has a very special coating and high melting rate. To avoid burn-through and excessive spattering, keep the arc as short as possible.

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ARABIA ESSEN WELDING & CUTTING 2013 during
7th -10th Jan 2013 at Dubai,
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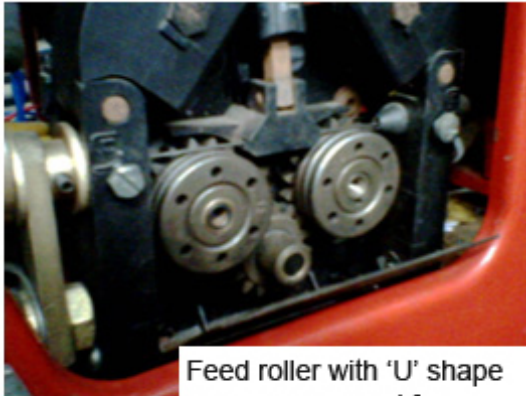
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of
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- **KING TIGER**

DRIVE ROLLERS:

For aluminum electrode wire, rollers with 'U' type groove are adequate. Select proper size of groove as per wire diameter. 'U' types grooves are used to avoid sharp edges ('V' groove) which shaves off soft aluminium wire.



Feed roller with 'U' shape grooves are used for aluminium wire

Once wire is shaved off, it changes shape and creates feeding problem through contact tip. During feeding wire from spool to roller and roller to torch, unsupported wire should be avoided. Unsupported wire has tendency to buckle; even small resistance is experienced by moving wire.

If possible use inlet and outlet guides fabricated out of nylon 66 or Teflon material. This material helps soft aluminium wire against deformation and prevents abrasion.

Tension on drive roll should be less as compared to what we apply in case of solid steel wire to avoid crushing of soft Al wire. The burr produced due to crushing accumulates in torch liner and obstructs feeding.

TORCH:

Problems with standard torch:

Standard torches with either EURO connection or standard connection are unable to give satisfactory performance for Al welding with 0.8 and 1.2 mm diameter wire due to following reasons.

1. The columnar strength of Al wire is 33 % that of steel wire which makes it difficult to keep its column while traveling through torch liner and tend to buckle even with small friction and obstacle along the path.
2. Any bend in the torch, created by welder during welding, disturbs wire feeding and results into wire burning at contact tip due to birds nesting at drive rolls.
3. Excessive pressure on wire deforms the shape of wire and creates erratic wire feeding.

Suitability of standard torch:

Standard torch with 3 meter or 4 meter length can be used for 1.6 mm and above Al

- Portable Gas Cutting Machine
- **KING JOIN - AGWT / HT-1**
Gas Heating Torch
- **KING PANTHER**
Portable Gas Cutting Machine

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KING Series of Welding Accessories



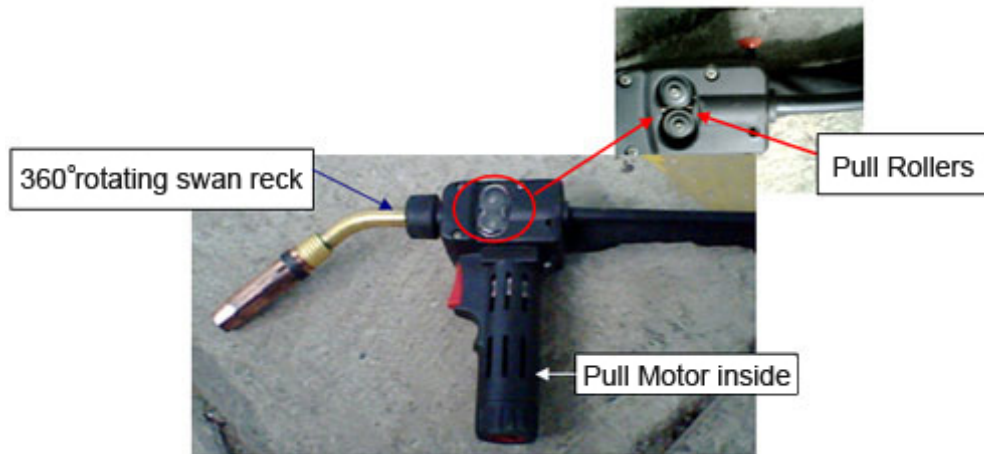
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- **KING SHIELD- HAND (83 X 108mm)**
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wire of grade 5356 by keeping torch straight. It is preferable to use 4 roll drive mechanism to ensure gentle pressure on wire. All other accessories such as 'U' groove rollers, Teflon liner and proper contact tip must be used to get trouble free welding.

PUSH PULL TORCH:

To feed 0.8 mm and 1.2 mm Al wire we should use push pull torch for satisfactory welding. More ever these torches can be feed all diameters and all grades of aluminum. We can get these torches in 4, 6, 8, 10 meter length as per customer requirement.



FUNCTION OF PUSH PULL TORCH:

A push pull torch has following main components

- Euro connector
- Gas passage
- Torch current cable
- Liner
- Contact tip
- Pull motor with rollers
- Torch neck

Out of these components liner, pull motor with roller, contact tip, torch neck, drive rolls of push wire feeders are main parts for push pull torch.

PULL MOTOR WITH ROLLER:

FREE SERVICE CLINIC
can be arranged on request if you have 25 or more numbers of AWL make welding and cutting equipment at single site/ nearby site. For Further Details Please E-Mail to cmo@adorians.com



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**For Welding &
Cutting Equipment,
Service & Spares**

Ador Welding Academy (AWA)

Wire is pushed by conventional wire feeder and simultaneously pulled by pull motor. Pull motor is located in torch handle. This arrangement avoids friction in liner while feeding wire from spool to contact tip. As per load pull motor matches linear speed to main wire feed motor. Pull motor behaves as take up motor. It takes wire from push motor and delivers to weld puddle through inbuilt drive roll and contact tip. Voltage rating of pull motor is generally 24 v dc or 42 v dc and supplied through power source.

LINER:

Aluminum is softer than steel and hence Teflon liner is preferred to reduce friction between Al wire and Teflon material. Teflon liner offers less friction to Al wire as compared to steel liner and so wire feeding is smooth. Teflon has low coefficient of friction and it gives slippery feel to wire. This is why it is used for feeding of Al wire.



CONTACT TIP:

As Al has more thermal expansion than steel, bore of contact tip should be higher by 10 to 20 % to accommodate expanded Al wire. Otherwise during welding tip and wire gets heated and it results into erratic welding due to irregular wire feeding.

SWAN NECK:

The neck of gun is usually bent by 45 to 30 degrees so that wire travels smoothly up to weld puddle through contact tip. Neck with 360 degrees swiveling angle is best for all position welding.

SHIELDING GASES:

1. Pure argon
2. Pure helium
3. Argon helium mixture

RECOMMENDATIONS:

1. Use Argon or Helium or mixture of both as shielding gas for Al welding
2. Polarity: DC +



**A Cost Effective Model to
Create New Welders and
Upgrade Skills of Existing Welders**

3. Use pulsed MIG equipment for better welding in difficult positions like vertical welding.
4. Stick out more than 15 mm. (spray mode welding)
5. Al has higher melting rate, so requires higher wire speed.
6. As thermal conductivity is high, travel speed should be more



Typical setup of GMAW process for Aluminum welding with Pushpull Torch.

7. Use forehand welding techniques to ensure shielding gas is ahead of welding arc.
8. Up to 250 ampere, use gas cooled torch; above 250 ampere use water cooled torch.
9. Use push pull torch for 0.8 and 1.2 mm Al wire.
10. Contact tip with higher bore size.
11. 'U' groove rollers
12. Teflon liner

For assistance in selection of welding equipment as well as precautions to be followed for defect free welding of Aluminum and its alloys, please write to cmo@adorians.com or visit www.adorwelding.com



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