



Johnson Matthey
Metal Joining

Silver-flo™ 55 Silver-flo™ 24 Cadmium-free Easy-flo™ Flux Powder



CADMIUM-FREE BRAZING FOR MODEL ENGINEERS SOME QUESTIONS ANSWERED

By Phil Webb, Sales & Marketing Manager Johnson Matthey Metal Joining

By now most model engineers will have heard something about the EU ban of cadmium containing products and how it has resulted in a ban of cadmium containing brazing filler metals including the popular Johnson Matthey product Easy-flo™ No.2.

This article explains some of the background behind this development, explores the implications and looks at the choices facing model engineers, who for many years have favoured the cadmium containing Easy-flo™ No.2 or equivalents.



Why have cadmium containing brazing filler metals been banned?

Cadmium bearing filler metals have been banned as a result of the comprehensive and overarching European Union legislation on the European chemicals industry known as REACH.



REACH is a European Union regulation concerning the Registration, Evaluation, Authorisation and restriction of Chemicals.

It came into force on 1st June 2007 and replaced a number of European Directives and Regulations with a single system.

Under EU Law over 100 substances were placed on a priority list for risk assessment by EU member states. Included in this list was cadmium and its compounds. Cadmium has been used in a very wide range of products including paints, plastics, jewellery and brazing filler metals and all these areas have been affected by a ban.

REACH aims to provide a high level of protection to human health and the environment from the use of chemicals. Since cadmium and its compounds are considered eco-toxic it is not difficult to see why a ban has been applied under REACH.



Eco-toxic cadmium, mercury and lead as they appear in the periodic table

I've heard that the ban on cadmium in brazing was a UK 'led' initiative. Was it?

It wasn't....Belgium's Federal Ministry of Health, Family and Environment assessed cadmium and its compounds in 2007; a 2,000 page report was produced and approved by member states in 2008.

When Johnson Matthey learnt of this report in 2008 we started to try to inform our remaining cadmium containing customers to encourage them to start using cadmium-free products. In this respect we are proud to have been ahead of the game to some extent.

The next phase of the REACH process was that, in 2009, impact studies were undertaken on behalf of the EU by a UK based company of chemical industry consultants RPA Ltd. These studies involved consulting widely with industry and tried to engage with individual users.

Did Johnson Matthey sit on a steering committee and how will brazing filler metal suppliers benefit from this ban?

No Johnson Matthey Metal Joining was not on a 'steering committee'. Johnson Matthey did, no doubt like the other suppliers of brazing products who responded, brief RPA Ltd. on our business in the area of cadmium containing filler metals and completed a comprehensive questionnaire. The full impact study report produced from the consultation done by RPA Ltd. is still available online.

There is clearly a marginal benefit to all suppliers of brazing filler metals because the cadmium-free brazing filler metals cost more, because they contain more silver than their cadmium containing equivalents.

From Johnson Matthey's point of view the main benefit is a move to more sustainable

products - something we have been working towards as a Company for several years now (see [www.matthey.com /sustainability/](http://www.matthey.com/sustainability/)).

Our goal at Johnson Matthey is to grow our business - but to grow it sustainably. We believe that resource efficient, environmentally responsible manufacturing and supply of products can deliver sustainability benefits for our customers and can be a commercial advantage for the Company.

'Why was model engineering affected when the average model engineer only uses a few rods, doesn't pollute the environment or put themselves or others at risk?'

You'd have to read the RPA study to get an understanding on this point. However, it is fair to say that there is a well-known and documented health risk from using cadmium bearing filler metals incorrectly, and under REACH legislation the EU are trying to reduce the amount of heavy metals used in our environment. Model engineering is not alone and most applications for these brazing filler metals have been affected by the ban.

'Do the cadmium-free alternatives work as well?'

It is fair to say that within model engineering circles there has been some negative commentary about the standard cadmium-free alternative especially before the ban. Some of this may have originated from people who have tried to use the cadmium - free alternative to Easy-flo™ No.2 (Silver-flo™ 55) and struggled to apply the extra heat needed to get it to flow freely.

We can say that cadmium-free alternatives such as Silver-flo™ 55 have been adopted throughout industry without any technical issues or joint failures that we are aware of and very minimal operator resistance.

'So what is Silver-flo™ 55?'

Johnson Matthey developed Silver-flo™ 55 in the 1940s when there were fears that cadmium supplies would run out. It was specifically developed as a cadmium-free replacement for Easy-flo™ / Easy-flo™ No.2 mirroring as closely as possible their characteristics.

Silver-flo® 55				
Composition	Ag	Cu	Zn	Sn
	55	21	22	2
Melting Range	630-660°C			
Specification	ISO 17672 Ag155 (formerly EN1044: AG103)			

Silver-flo™ 55 is classified as a low-melting free flowing brazing alloy. It is Johnson Matthey's highest-selling silver brazing alloy and is used throughout the brazing industry in aerospace, medical, transport, electrical and gas and liquid pipe applications for example.

With the right heating method and technique, adequate fluxing, correct joint gaps and set-up it can penetrate superbly well even on heavy and difficult to heat components.

'Does Silver-flo™ 55 flow as well as Easy-flo™ No.2?'

This is a question that we are often asked. There is no doubt that Easy-flo™ No.2 takes some matching flow-wise but getting an alloy to flow is all a question of temperature. If a brazer is used to Easy-flo™ No.2, and has learnt how to judge (from the look of the flux and colour of the metal etc.) what temperature he / she has reached then they will need to adjust their thinking for Silver-flo™ 55 which needs another 40°C to flow freely.

It is correct to say that Silver-flo™ 55 will not flow as well as Easy-flo™ No.2 at Easy-flo™ No.2's brazing temperatures. But get Silver-flo™ 55 above its liquidus and

with the right joint gaps of 0.002-0.005” (calculated at brazing temperature) then there is no reason that Silver-flo™ 55 will not flow and penetrate very successfully.

‘What heating methods should be used?’

Boilermakers using oxy-acetylene may not even notice the difference between Easy-flo™ No.2 and Silver-flo™ 55 because the calorific value of the flame / flame temperatures involved are more than able to heat the components to brazing temperature quickly. Where air-propane is used as a heat source, depending on the size of the parts to be brazed, the time taken to reach brazing temperature will be marginally longer for Silver-flo™ 55. However, this heating method is still adequate to achieve good filler metal flow.

If you are new to brazing then why not visit the technical section of the Johnson Matthey website (www.jm-metaljoining.com) where you can view the ‘Six steps of Successful Brazing’ as video clips?



‘Which flux is compatible with Silver-flo™55?’

The same flux that has always been used with Easy-flo™ No.2 - Easy-flo™ Flux Powder is compatible with Silver-flo™ 55.

‘Can Silver-flo™ 55 be used near joints made with Silver-flo™ 24?’

We recommend Silver-flo™ 55 for step brazing operations where the first joint is made with Silver-flo™ 24 and have done so for many years without any issues. What has been found is that the higher melting brazing alloy will tend to re-melt above its original melting range providing a larger process window between the two brazing alloys.

	Filler Metal	Melting Range
First brazed joint	Silver-flo™ 24	740-800°C
Second brazed joint	Silver-flo™ 55	630-660°C

‘Do the cadmium-free filler metals cost more?’

Yes, sorry they do because they contain more silver and with record-high silver prices at the moment the difference is magnified.

‘Do users have to change to cadmium-free brazing filler metals?’

Yes, cadmium containing brazing filler metals must not be bought, sold or transferred in any way since December 10th 2011.

‘Can old cadmium containing stock be used up before switching over?’

One interpretation of the regulations is that stocks already in possession of a particular legal entity can be used after the date above, but may not be transferred to another legal entity. Some commentators have interpreted the legislation to mean that cadmium containing filler metals are also banned for use. Either way Companies or individuals should avoid using cadmium containing products and definitely should not buy, sell or import them.

‘Are there any other changes coming to brazing?’

Yes there are. Under REACH fluxes containing borax or boric acid will carry a different hazard warning: the toxic pictogram (skull and crossbones symbol) may well begin to appear on flux packaging. The formulations will not have changed but the legislation about labelling has. Johnson Matthey is currently looking at this issue in some detail. Visit www.jm-metaljoining.com to get up-to-date information on this issue.

How to find out more



Johnson Matthey

Metal Joining

Johnson Matthey Metal Joining is committed to promoting safe cadmium-free brazing.

If you would like to find out more on this subject email Metal Joining on **cadfree@matthey.com**

or visit our website at **www.jm-metaljoining.com**

for more information, or contact us on **+ 44(0)1763 253200.**

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