

INDEX 

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Target Audience
All FOD Inspectors

CONTROL OF NOISE IN HEAVY FABRICATION

This SIM identifies the main sources of noise in heavy fabrication and provides guidance on reducing this noise through alternative ways of working.

BACKGROUND

1 The 2001/2002 Engineering and Utilities Sector Strategic Plan objective on noise is part of a long term strategy for reducing exposure to noise. The issue of noise is to be raised during preventive inspections at engineering premises where the second action level is exceeded. Heavy fabricators in particular are to be targeted.

HEAVY FABRICATION

2 Heavy fabrication is generally classified to SICs 28110 and 28300 but is in fact several industries including companies engaged in the fabrication of larger scale metal products such as for use offshore, as bridges, in chemical manufacture, other pressure vessels, storage silos, structural steelwork, etc. The use of metal plate is a common feature.

3 Heavy fabrication activities can produce very high levels of noise albeit intermittently. Consequently, observations made on a single visit may not be sufficient to make an accurate judgement on noise levels. Appropriate questions should therefore be asked about the processes that may be undertaken in order to determine if there is a noise problem. This should include identifying whether or not a noise assessment has been made of the various work activities and if so, is it adequate.

4 The need to correct faulty work can involve processes which produce high levels of noise. Alternative ways of working which lead to more accurate initial fabrication can, by avoiding rework, result in reduced noise exposure and improved efficiency. But this may require investment in, for example, the training of workers. However, even those who work to high standards of initial accuracy may, from time to time, have to undertake some form of rework. Enquiries should be made of the processes and the tools/equipment used for this work.

5 Many of the tools and equipment associated with high levels of noise in fabrication also have potential to expose users to hand-arm vibration (HAV). Any assessment of the suitability of such tools and equipment should also take account of this. See also SIM 3/2001/05 *Hand arm vibration - safe use of hand-held power tools* and [OC 246/31 Reducing risk of hand arm vibration injury from hand-held power tools](#).

6 The basic processes in fabrication involve:

- (1) cutting of metal;
- (2) assembly - largely by welding; and
- (3) finishing - including application of surface coatings.

NOISE LEVELS

7 Typical noise levels produced by tools and equipment of concern and used in these processes are set out in the table below.

Process	Item	Measured range of noise dB(A) *
Cutting	Plasma arc cutting	Up to 110
Assembly	Chipping tool	122 to 128
	Grinding	85 to 109
	Arc air gouging	104 to 125
Finishing	Needle guns	103.00
	Abrasive blasting	95 to 135
	Water jetting	108 to 111

*Measured at the operator position.

CUTTING

8 The choice of cutting process is usually driven by a combination of economic and technical factors. Oxy-fuel (usually propane or acetylene) cutting is most common in fabrication. Generally, it does not give rise to a noise problem except when cutting steel plate which is more than 40-50 mm thick or when a large number of cutting torches are used simultaneously, as in mechanised cutting. In such cases noise levels in excess of 90 dB(A) may result. Plasma cutting is often favoured for thinner materials and is technically favoured for stainless steel. The use of laser cutting is expanding but has thickness limitations.

9 Whilst the main contribution to noise from cutting is from the process used, there are implications for subsequent assembly. Inaccurate cutting leads to difficulty in subsequent assembly and the potential for the use of tools/equipment which generate high levels of noise. Where there is poor control of cutting out, it is common to allow surplus for removal during assembly; this surplus may be known as 'green'.

10 Of the cutting processes described, plasma cutting has the potential for highest noise levels. Control is described in [OC 668/22 Plasma cutting: control of fume, gases and noise](#). See also [OC 668/30 Oxy-fuel gas cutting: control of fume, gases and noise](#)

ASSEMBLY

11 The processes used during assembly which have the highest potential to produce noise are associated with correction of defects. The potential for this can be limited by good design, dimensional control and accurate cutting out.

12 As assembly is largely by welding, it is essential to recognise that this process will result in shrinkage and distortion. This can be allowed for in design and by the approach adopted, particularly to the sequence or order of assembly.

13 Where distortion can still arise, the components can be 'restrained' but the method selected can have noise generating implications. If ad-hoc restraints are used (often known as 'strong backs') they will be welded onto the components and will require removal which might be by chipping or gouging tools and subsequent grinding. Non-welded aids are available (see *Noise reduction in shipyards Booklet 1 Fairing* subject file 730). If these cannot be used, restraints can be attached using studs welded to the components (stud welding); this produces a smaller weld 'footprint' and hence reduces problems associated with removal. Where distortion does arise, similar anchorage points can be used to realign components. A better alternative is the use of heat line bending which involves the systematic application of flame heating and cooling.

14 While welding procedures may vary, the edges to be welded usually require some form of preparation. This is mainly as an angle on the edge and finishing of the edge after cutting. The angle is best applied during cutting; subsequent use of a chipping tool is particularly noisy. Edge finishing is usually by grinding.

15 The 2 basic welding procedures are single or double sided. There are conflicting implications for noise generation. Single sided welding can produce more distortion (but this can be allowed for) whereas double sided welding often involves back gouging of the root of the first weld.

16 Back gouging can be avoided by the use of weld backings such as ceramic tiles, weld backing strips, etc. These are attached to the backside of the weld opening to support the molten weld metal and help prevent root weld defects. Weld backings are available for use in double and single sided welding. The full advantages of single sided welding depend on their use. Changes to welding procedures such as changing from double-sided welding to single-sided welding, usually require 'approval' in terms of BS 4870 *Specification for approval testing of welding procedures*.

17 Regardless of which welding procedure is adopted, gouging may need to be carried out, eg if a defect is detected in the weld. Thermal gouging or grinding may be used. For minor defects, grinding is usually adopted but more extensive defects may require thermal gouging. The main thermal gouging processes (in order of increasing noise

generation) are: flame, plasma and arc-air or carbon arc. The use of chipping tools for gouging may be encountered and is particularly noisy. Further guidance on selection of gouging processes is in preparation.

FINISHING

18 Finishing processes most likely to give rise to a noise problem are grinding and preparation for surface coatings. Grinding may be cosmetic rather than necessary and should not be used without justification. Finishing processes are also encountered in connection with repair, including renewal of the original coating.

19 Two methods commonly adopted for surface preparation are abrasive (shot) blasting and the use of needle guns. Needle guns often require long periods of use and should be avoided although they may need to be used in awkward places.

20 Abrasive blasting creates health and safety problems primarily for those involved (see [OC 634/7](#) *Direct pressure blasting equipment* and [OC 634/8](#) *Control of dust and noise exposure during direct pressure blasting*). There are also environmental pressures on this process. More use could be made of ultra high pressure water jetting particularly where needle guns have been used extensively.

21 A common objection to water jetting is the resultant flash rusting but coatings are available which are designed to cover this. There is widespread ignorance of such surface tolerant coatings. These coatings can be used on surfaces requiring less thorough preparation, including water jet prepared surfaces. International standards for preparation by this method are being drawn up and are expected to be published by BSI as part of BS 7079: *Preparation of steel substrates before application of paints and related products* which currently includes standards for surfaces prepared by hand/power tools and by abrasive blasting. In the interim, most marine coating manufacturers have issued their own standards for hydroblasting upon which they will give guarantees.

22 Contractors are often employed for surface preparation and should be expected to adopt alternative processes and reduce exposure to noise. Fabricators should be expected to assess the competence of their contractors in this aspect.

GENERAL APPROACH TO NOISE REDUCTION

23 As discussed above, there is much potential to reduce exposure to noise by changing the way work is done. There may be instances where the use of tools/equipment which produce high levels of noise cannot be avoided. However, this should be limited just to those cases where their use is absolutely necessary. The use of more than one process may be appropriate.

24 In the case of particularly noisy processes such as the use of chipping tools, needle guns and arc air gouging, they should be carried out in locations or at times where only those actually engaged in the process are exposed. This could also be achieved by isolating the use of these tools by enclosure. Using permits to work to issue such 'noisy' tools/equipment should also be considered.

25 When considering alternative ways of working to reduce noise exposures, the rate of work (and hence the exposure times) should be considered in addition to the noise levels. The benefits of a quieter process could be reversed if the length of time taken to complete the task is longer than with a noisier process.

26 It is essential that once noise reduction methods have been introduced an assessment is made to identify whether there is a continuing need for ear protection to be worn/provided. Where this is the case it is important arrangements are in place to provide the necessary training and supervision. The use of ear protectors should not however be regarded as a substitute for noise reduction.

FURTHER GUIDANCE

27 Noisy processes in fabrication shops are similar to those in shipyards and the guidance on noise reduction published by the Shipbuilders and Ship-repairers Association (SSA) can be applied. Availability of these guidance notes is described in OC 730/14 and a list of current guidance notes is given in SIM 3/2000/07. The SSA guidance notes which will be of particular value are:

(1) SSA guidance note No 9 from the 1991 to 1994 series *Guidance on noise reduction in steelwork repair and noise reduction when replacing surface protection systems*;

(2) SSA guidance note No 5 from Volume 2 *Reduction and control of noise and vibration in shipyards*; and

(3) [SIM 3/2000/15](#) - *Alternative ways of working to reduce exposure to hand-arm vibration in shipyards* is also relevant to fabrication.

28 Further information can be obtained from: The Shipbuilding, etc Sector Group, The Engineering and Utilities Sector, Newcastle-upon-Tyne, VPN: 519 6200

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TOP **A**