



Product Group Report: Compressors

An analysis of trends and potentials in the remanufacture of industrial compressors.

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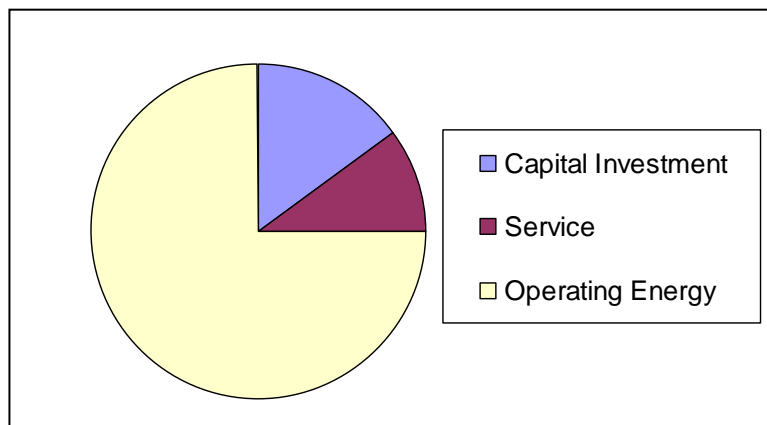


1 Overview

Compressors are found operating in a huge range of industrial and domestic environments, as well as in the automotive and aerospace sector. To maintain a realistic amount of detail, this report will concentrate on use for industrial applications, excluding HVAC. The domestic market is dominated by low value products that are considered uneconomical to remanufacture, and hold little or no resale value. The HVAC, automotive, and aerospace sectors should be discussed separately, as the market conditions for these products are very different to industrial plant.

The downturn in traditional UK manufacture has meant that the market place for industrial plant has changed over the last 10 years. The demand for large industrial compressors has decreased due to the fall in number of large factories. There is however steady demand from pharmaceutical companies and blue chip firms for lab based equipment. The prosperous oil and gas industry is also a large user of gas compressors. The growing globalisation of the equipment market has brought about entry in some sectors from cheaper Asian brands, forcing UK manufacturers to exit from certain low spec markets.

When assessing the environmental impact of any industrial machinery, it is vital to consider the total life cycle energy usage, not simply the initial production energy. This is an important factor when making a decision on whether to remanufacture or recycle a used piece of equipment. The chart below shows the cost of running an air compressor over its lifetime.



Source: Good practice guide – Compressing air costs

With 75% of the overall cost attributed to operating energy, the purchasing cost and thus embodied energy of the product (15%) becomes a secondary consideration. Where a more efficient new product is available, it may make economic and environmental sense to recycle the old unit and install a new one. The data for pumps and fans also highlights the operating energy to be a major factor in the remanufacture / recycle decision. It may be possible to upgrade cores to incorporate new, more efficient technology. It is therefore necessary to evaluate each case individually.

Compressor technology has recently seen a significant step change in efficiency. The concept of variable speed drives is not new, but has only recently been introduced on a widespread basis. Rather than cycling, the new variable speed drive compressors will adjust the speed of the unit to match the required load. Whilst users with a constant fixed demand for air will not benefit from this technology, installations that have a variable demand will experience up to a 40% reduction in energy usage. This will mean that in many cases, a remanufactured unit will be significantly less efficient and thus should not be used. There is no information available regarding the remanufacturing of variable speed units as they are so new to the market.

Unlike in the industrial pump industry, compressor OEMs play little or no part in the remanufacturing of their products. There are a large number of small, independent companies and OEM distributors carrying out refurbishment and servicing of compressors. Although none of these claim to remanufacture, many do state that compressors will be returned to full manufacturer's specifications upon refurbishment. If this is the case, then this could be deemed remanufacture. Most companies interviewed stated that refurbishment formed only a small part of their business. It was suggested that the level of remanufacture is actually decreasing as distributors for the OEMs are curtailing their activities. The level of refurbishment is also strongly dependant on geographical location due to the differing concentrations of particular industries in different regions.

When a compressor reaches the end of its useful lifetime, it is generally considered as scrap. OEMs claim that due to the complex balancing involved, in particular for rotary screw compressors, remanufacture is uneconomical. The only exceptions to this are bespoke units where there is no available replacement or where the value of the unit exceeds around £10,000 – £12,000. This does not include a huge number of small to medium capacity compressors, typically those that smaller firms or start ups may look to purchase.

2 The product

There are two main types of compressor that are used by the majority of industrial users: reciprocating and rotary screw. Reciprocating units tend to be found at the cheaper end of the market and so are less likely to be remanufactured. They are used widely in larger applications but are being replaced by the quieter and cheaper rotary screw design. The import market has penetrated this sector with cheaper units, creating a “throw away” culture amongst users. Rotary screw compressors are the most common type found operating at a permanent factory site, with one or more central unit(s) supplying compressed air to the entire facility. In both types of compressor, the actual compressing unit or “air end” makes up only part of the total units mass. With the static compressors in particular there is normally a chassis, electrical control system, motor, outer casing and sound deadening, air receptacle and manifold. There may also be a concrete foundation for very large units, although this is becoming less common.



3 Evolution rate

Until very recently, the compressor industry had not seen significant technological change for many years. The introduction of variable drive speed (VDS) units has made a real impact in certain sectors and represents an important gain in efficiency for operators. This obviously has an impact on the remanufacture of the old, less efficient compressor models. It is unlikely however that another new technology will replace the variable speed units before they begin to reach the end of their lifetime. This means that there could be a case for remanufacturing variable speed compressors as they begin to wear out.

The control unit that monitors the compressor and alters drive speed represents a large proportion of the cost of the unit. They are complex and difficult for non OEM companies to service. It may be that because of the cost of this new technology that the VDS units are un-economical to remanufacture. If a larger market did develop, however, the OEMs could introduce a new breed of VDS models which are easier to service or have easily replaceable sub-systems.

There is also a trend towards adding more functionality into the compressor package. Most industrial units of any substantial capacity will often now be fitted with air treatment equipment as well. This has pushed up the price of compressors, but it does mean that the customer gets a complete pressed air solution in one “box”.

4 Value

The value of remanufactured compressors is between 60% and 75% of a new unit. Operators tend to opt for a new unit if the cost for remanufacture is in excess of 75% of new. It is far more common for a unit to be remanufactured for its existing owner, and these jobs tend to attract prices in the lower end of this price range, say below 70%.

One of the most expensive components in a rotary screw compressors the set of screws. These must be a matched, balanced pair. There should be very little wear to these components in normal use, provided adequate care has been taken to ensure the air is well filtered. If they have come into contact with each other whilst in operation however, they will need to be renewed. The quality of the cores therefore will have a large effect on the profitability of any remanufacturing operation.

Items such as the air receptacle and manifold will have a value even if removed from the original machine and could be remanufactured to use as parts for new machines or as spare parts. Manufacturers could enhance this value by standardising these items so that a component from an obsolete compressor could still be used as a spare for a newer model.



Compressors have an inherent scrap value. The vast majority of their weight consists of steel, cast iron or aluminium, all of which have well established recycling routes. Motors also contain copper windings which may be recycled. There will usually be a small amount of electronics and plastics that are less easy to recycle.

5 Reconstructability

By their very nature, compressors are designed for regular service and renewal of high wear components. This means that they must be easily disassembled and re-assembled, normally with basic workshop tools. They are therefore ideal candidates for remanufacture

The VDS control units are very complex and it is normally necessary to replace the entire unit if a fault occurs. They are not designed to be serviceable or to have components changed. This would mean that remanufacturing of these units would need specialist equipment, and possibly have to be done by the OEM, or licensed sub contractor.

6 Potential

Although the UK market for industrial compressors is not a fast growing sector, there is still significant activity. There are a huge number of compressors currently in service, many of which are of a size that would warrant remanufacture. With the introduction of VDS technology, many customers who would previously have opted for reconditioning of an old unit will choose to purchase a new compressor to take advantage of the improved efficiency and associated government financial aid. This means that the total market for older units will be greatly reduced. There will remain a small market in facilities which have a fixed base load that is best suited to a standard compressor, not a VDS.

The high cost of VDS compressors may in fact stimulate demand for remanufactured units once the ones currently in service come to the end of their life. This will be dependant on co-operation from OEMs so that the VDS control system can either be remanufactured or replaced economically.

There is no technological reason why any compressor, within reason, cannot be remanufactured. Remanufacture is well established in many other sectors with similar products that require similar techniques and knowledge. The main barrier to remanufacture currently appears to be the attitude of OEMs towards old units. Some offer an exchange service on worn rotary screws, but the old parts are simply recycled and not remanufactured. With a large network of distributors and service agents, there would be no logistical problem with recovering old cores,



possible on an exchange basis. Some firms do offer to take back old units but choose to recycle them rather than recover usable parts.

Financially, it is likely that only compressors of over £1000 would realistically be considered for remanufacture, particularly as the cheaper end of the market is extremely competitive.

7 Policy options

- Extend the government grants for energy efficiency to cover equipment that has been remanufactured – Taking into account the carbon saving made by remanufacturing as equal with that made by operating more efficient equipment could encourage more operators to consider refurbishment or remanufacture in borderline cases where they would otherwise have opted for a new machine.
- Introduce a rating system where by an operator purchasing a new piece of equipment may compare its suitability for remanufacture and upgrade with other products. This then gives them the choice of opting for equipment with a view to remanufacture as a planned maintenance operation. This would enable predictable costs over a longer period than the normal expected lifetime of the pump.
- Produce promotional material aimed at operations managers from small to medium sized facilities, clearly describing the benefits of using remanufactured compressors.

All of the above could stimulate market demand for remanufactured compressors. This should help to encourage OEMs to develop their capabilities. It could also encourage the many small service companies to improve the standard of their refurbishment programs.

8 Model

Because any current remanufacturing of compressors is happening on a low level through small firms, it is difficult to estimate the market size. The size of the total market for new compressors is estimated to be £100 million. Industry growth is low at around 1%. The most common user, numerically, of industrial compressors is the medium sized factory unit. These normally employ a 30KW unit. The model will be based around this style of compressor.



Assumptions:

- A total market size of £100 million for new compressors. With an estimate of 1/3 of.....
- An annual Market growth of 1%.
- A compressor mass of 800kg. The majority of this mass will be iron or steel. The resultant mass of CO_{2E} produced during the manufacture of this unit would be 2650 kg³.
- Possible 1330kg³ CO₂ saved by recycling the old unit as scrap metal.
- The cost for such a compressor would be approximately £10,000.
- From estimated industry size and average compressor cost, xxxx compressors are remanufactured every year in the UK.

Table1: Intervention model assumptions.

Scenario	Overall output and assumptions	Possible policy Interventions	Units Saved From Landfill ('000)	Tonnes diverted From Landfill (kt)	CO _{2E} (kt)	£bn Spent On Reman Products
Ref 1	The proportional level of remanufacture remains constant at 2006 levels, with an increase of 1% in line with overall industry growth.	None				
A1	The proportional level of remanufacture increases at a rate of 5% pa after 2010	Encourage remanufacture through government energy grants				
A3	The proportional level of remanufacture increases at a rate of 8% pa after 2010 due to rising raw material costs	Same as A1				

