

Undergoing testing at Wirksworth on the Ecclesbourne Valley Railway in April 2019, the first of five Clayton CDB90 hybrid locos for Tata Steel's Port Talbot plant. The final two, which were placed as an additional order, are due to be delivered next year. (Clayton)

Although best-known amongst enthusiasts for its British Railways Type 1s, Clayton Equipment has a reputation as a global supplier of specialised locomotives. As Graeme Pickering explains, more staff have been recruited and a bigger factory is planned due to demand for its hybrid machines.

From a site on an industrial estate in the leafy suburbs of Burton upon Trent in Staffordshire, Clayton Equipment Ltd supplies locos to customers all over the world. When I visited, virtually every inch of shop floor space was in use and work was being carried out for four separate customers. Narrow gauge mining locos, being assembled for shipping to buyers in Canada and Peru, were dwarfed by one of Tata Steel's new standard gauge hybrid shunters standing alongside them.

"If you go back in time to, say, six years ago, our business was probably 80% export and 80% mining. Now it's 80% shunting or hybrid surface rail and 70% UK, so there's been a big market shift," explained Clayton's Managing Director Clive Hannaford. "The first one we really pushed was Tata. Since then the market has just gone exponential and the interest and demand for our product is great. That's what's driving things at the moment" ➔

Clayton Building on success



ABOVE: Seven CD40 diesel locos were ordered from Clayton to power works trains for the Crossrail project. They were the first in the world supplied with Stage IV emissions-compliant engines. (Clayton)

RIGHT: As well as building locos from scratch, Clayton offers re-engineering services. Ten Schöma diesel locos were converted to run on battery-electric motive power for London Underground, allowing them to be used on engineering trains in deep tunnels on the system that had previously been out of bounds due to diesel emissions. (Clayton)

In demand

Tata placed an initial order for three 90 tonne CBD90 Bo-Bo locos to move loads of 2,500 tonnes at its Port Talbot works in Wales. The hybrid configuration consists of a traction battery delivering power to 416kW maintenance-free, high torque electric motors. The battery is charged via a low emission EU Stage V-compliant diesel engine. The locos were the largest to be built in the UK for more than 20 years and the frames used steel supplied by Tata's Plate Profiling Centre at Wednesfield in the West Midlands. The first completed loco arrived at Port Talbot in spring last year, and as the third was being finished this March Tata confirmed it would purchase a further two, due for delivery in 2021.

Clayton has also agreed a contract with Beacon Rail Leasing for the supply of 15 CBD90s with an option of more to follow. Meanwhile, two CBD80s (an 80-tonne variant of the hybrid Bo-Bo) are being built for Sellafield Ltd, the subsidiary of the Nuclear Decommissioning Authority, which runs the Sellafield nuclear site in West Cumbria.

"There are obviously common bits in the arsenal, but all are a bit different to suit everyone's requirements," observed Hannaford. "We've got options on Beacon to go up to 135 tonnes, so that will be a Bo-Bo-Co or Co-Co. Of course, there are some applications where customers we think will need a bigger loco than 90 tonnes. We could

push it to 100 tonnes as a Bo-Bo, but there are some big sites that need big loads so we'll need more mass, which is fine. Part of the Beacon contract is an option to size-up the locos if needed. They'll take longer and cost more, and all those sorts of issues, but it gives a bit more flexibility."

He continued: "On the face of it, as you walk past, they all look the same but for the colour, but they're not. The Tata one has hydraulic brakes because none of its rolling stock is braked. Tata's is a 90-tonne loco. Sellafield's weighs 80 tonnes with air brakes and Beacon's is a 90-tonne with air brakes. They're all similar, but they're all a bit different. Sellafield have got extra safety features because of the site requirements."

The company says its hybrid designs have led to a record number of new contracts and forward orders, which in turn has meant a need to increase its workforce by 40% to cope. "We've had to employ a lot more people, including fitters, contracts managers and design engineers across the whole department just meet that demand," added Hannaford. "So much so that capacity is the issue. We physically can't get the stuff out of the door. The size of the building doesn't permit any more than we've got at the moment so, unfortunately, we're giving people long lead times, which is unusual for us. It might be normal within the railway but our typical lead time is six to nine months. At the moment it's one to two years. We still want to get back to the six to

nine months." Consideration is being given to whether it would be better to expand the existing factory or move to another site in the area. "A decision needs to be made fairly soon," he admitted, "but it's still early days."

Hannaford noted that, unsurprisingly, there have also been plenty of expressions of interest in Clayton's products. "We've got enquiries for more than 200 locos," he said, estimating that if these were realised it would keep the factory going for several years.

In recent times, Clayton-built products have also played key roles in infrastructure projects. In 2018 the firm completed work on a construction train, which at 500m in length is the world's longest. An order fulfilled for locos to work construction trains for the Crossrail project saw it produce seven 40-tonne machines, which were the first in the world to be Stage IV emissions compliant. "They're still being used," remarked Hannaford. "It's winding down now really, but they have taken some hammer."

Clayton also has the capability to carry out re-engineering. It converted ten Schöma-built CF-500 diesel locos to battery-electric power for London Underground. As diesel locos they had seen little use due to their unsuitability for working through the system's deep tunnels. Conversion to zero emission power sources, giving the ability to draw current from an onboard battery as well as electrified rails, provided flexibility for use on works trains during engineering occupations.

Company history

Clayton Equipment Ltd took on its present incarnation as a standalone company in March 2005 after half a century as a subsidiary of various engineering

groups. It was formed in 1931 by Stanley Devlin to supply spare parts for products manufactured by Clayton Carriage & Wagon Equipment, which had gone into receivership. Initially working on his own, Devlin, who had been Chief Draughtsman for the erstwhile company, managed to grow the business and diversify, relocating to an office at International Combustion Ltd in Derby. Clayton was able to help meet a need for steelwork and products as diverse as farm buildings, elevators and conveyors following World War Two.

A move of premises to Hatton in Derbyshire in 1946 saw the business equip itself with machinery to build a wide range of locos and industrial equipment. While many orders were for export, others were produced for British Railways.

Having built bogies and superstructure for the first batch of ten British Thomson-Houston Type 1s for BR (D8200-D8209) in 1957/8, building of the second batch of 34 (D8210-D8243) took place at Clayton's works from 1959-61.

The company also designed and built what is probably its most widely-known yet least successful product for BR. From 1962-65, 88 Bo-Bo Type 1 diesel-electrics (D8500-D8587) were built by the firm, while the construction of the remainder of the 117-strong class (nicknamed 'Claytons' and later classified Class 17) was subcontracted to Beyer, Peacock & Company in Manchester.

BR specified a central cab and this necessitated the use of two six-cylinder horizontal engines (placed at each end) that were small enough to be housed in a low casing to provide good visibility for the driver. Of the Clayton batch, all except two (D8586/7, which were fitted with Rolls-Royce power units) had a pair

BELOW: The busy shop floor at Clayton Equipment's works in Burton upon Trent on September 1, with narrow gauge mine locos under construction. The firm is currently looking at options to expand or move premises due to the demand for its products. (Graeme Pickering)

BOTTOM: Components laid out for fitting to mine locos for export are assembled at Clayton's Burton upon Trent works in September 2020. (Graeme Pickering)





ABOVE: Clayton Type 1 D8525 rumbles through Barassie in Scotland on an unknown date. The locos were not a success and had very short lives with BR; one survives in preservation and is currently at Kidderminster on the Severn Valley Railway being repainted into BR blue. (Colour Rail)

of Paxman 6ZHL engines, each of which delivered 450hp, and had originally been designed for railcars. The engines proved problematic and required extensive modifications. BR's insistence on using the type it had already tested with aluminium crankcases (rather than cast iron ones as subsequently suggested by Paxman) was a contributing factor. Reliability issues continued so BR decided to dispose of the class and ordered another 100 English Electric Type 1s (Class 20s) as replacements. Withdrawals took place between 1968 and 1971. Many of the 'Claytons' had a working life of fewer than five years. D8568, which was purchased for industrial use after withdrawal in 1971

and subsequently entered preservation in 1983, is the sole survivor. Only one example of the BTH Type 1, built by Clayton in August 1960, remains in existence and the company has supplied drawings to the Class 15 Preservation Society to help it with its restoration. Clayton also made an attempt to interest BR in a higher-powered, central cab loco. DHP1 (standing for Diesel Hydraulic Prototype) was a Type 3, mixed traffic engine fitted with four Rolls-Royce C8 engines (delivering a total of 1,500hp) and a steam heating boiler. Completed in 1963, it's understood to have only completed a few local trial runs on the railway network, but BR interest in commissioning further new

designs with hydraulic transmission was waning and it was broken -up in 1967. In 1965, Clayton was subcontracted by Brush to build ten main line locos, almost identical to its British Railways Type 4s (Class 47s) for export to Cuba. Following a ban on virtually all trade between the United States and Cuba amid the countries' growing tensions, Brush had decided to outsource the order rather than risk tainting relationships with US clients of its parent company Hawker Siddeley.

Innovation

Although still working autonomously, by this time Clayton was a wholly owned subsidiary of International Combustion (Holdings). Its breakthrough into the development of locos for work in deep coal mines in Britain came in the 1960s after the decision by the National Coal Board to stop using pit ponies. After a number of small locos had been supplied, Clayton was asked to create a machine that could work on steeper gradients.

It developed the world's first rubber-tyred mining loco, with an impressive performance both in terms of haulage and tractive effort, which became a standard type for coal mine use. Clayton soon had 180 staff working on the development of flameproof locos for subsurface mine work. The gradual demise of the UK's coal mining industry saw the company change its focus to exports and diversification into the tunnelling and construction sectors. Owners changed too. International Combustion was acquired by Clarke Chapman in 1974 and this merged four years later with Reyrolle Parsons to form Northern Engineering Industries. This in turn was bought as part of a move into the industrial power sector by Rolls-Royce.

In March 2005, the firm's purchase from

BELOW: Two 800mm gauge rack and pinion hybrid locos were commissioned in early 2020 for use on the Snowdon Mountain Railway. They're the first hybrid locos in the world to be built for a rack and pinion system and have passenger pods in front of the engine and battery compartments that can carry 12 passengers. No 14 *Glaslyn* is seen on a commissioning run on August 13, 2020. (Snowdon Mountain Railway)



LEFT: A rarely -photographed loco that travelled very few miles and only underwent local testing on the rail network. Diesel Hydraulic Prototype 1 (DHP1) was a four-engine, mixed traffic Type 3 with steam heating capability produced by Clayton in the hope of getting a contract from BR for such machines. Completed in 1963, it was broken up just four years later. (Clayton)

MIDDLE LEFT: Clayton pioneered rubber-tyred mining locos. A Clayton Pony design is seen on test. (Clayton)



More often than not, the buyers who place orders with Clayton require only a small number of locos to perform very specific tasks on self-contained systems. For larger manufacturers the prospect of building as few as one or two machines for a client often isn't regarded as worthwhile, but Hannaford said it's very important custom for his company. "Because we're only a small company we can say that's fine. It's £1m. Whereas a big company would want 200 at £1m each. We win there. If we actually grow I want to keep that flexibility. Main line passenger or freight is generally high volume and they're markets we're not in. Every other thing – mines, tunnelling, surface rail, shunting, industrial sites – don't want a lot. They want one or two so it's a good fit. Beacon was unusual ➔ (Clayton)

Rolls-Royce as a management buyout saw it become an independent company once again and move from Hatton to its current premises. By relocating just six miles away from its previous base, Clayton was able to retain staff. Regional development agency funding helped it to secure and equip the new factory so that it could improve efficiency and design capability as well as being more responsive to the needs of the customer.

It's the ability to be flexible and offer truly tailored solutions to buyers that Clive Hannaford believes makes the company stand out: "We benefit because we don't have a standard product. We're not saying to a customer, 'Here's our catalogue, which one do you want?' We go from 1.75 tonnes up to 135 tonnes. That's such a broad product range and no-one else will do that. Having that bespoke service and getting what you want is great and that's what's bringing the business in. The gauge is whatever suits," he continued, and that applies to loading gauges as well as track. "We're quoting a loco at the moment for Peru and it can be no more than 1,600mm high. It doesn't matter what the loading gauge is. Yes, is the answer."



BELOW: Inside Clayton's Hatton factory. A Type 1 is nearing completion on the left. Behind it is DHP1, the company's Type 3 mixed traffic design produced by the firm in the hope of getting orders from BR for more powerful machines. On the right are Type 4s being built under contract to Brush for export to Cuba. Similar to the Brush Type 4s (later Class 47s), the company outsourced the work to Clayton due to political sensitivities. (Clayton)



ABOVE: Brand new British Thomson-Houston Type 1 D8225 was one of 34 built by Clayton between 1959 and 1961. (Clayton)

because it was 15, but even then, if you drill down, their potential customers aren't one customer that wants 15. Generally speaking, it is ones and twos."

Summer 2020 saw the commissioning of the world's first hybrid rack and pinion locos, which have been built by Clayton for the Snowdon Mountain Railway. The two 800mm gauge locos again use a Euro Stage V-compliant diesel generator to recharge a battery that powers electric motors, but on the descent from the mountain the batteries can also be charged using energy from braking. The design gives an increase in passenger capacity for each trip. A pod, which can accommodate 12 people, is attached to the loco chassis in front of the battery and generator compartments.

"Snowdon shared with us the rack element because we hadn't done rack locos and it's the only one in the UK that goes up a mountain," recalled the Clayton MD. "There are a few significant issues with the old design. They said they wanted to get rid of that element because it just doesn't work. It's too noisy and uncomfortable. It's unreliable. We took those points on board, but we've got the diesel-battery hybrid technology and the motor technology and putting the two together really came up with a decent product. They can't get the parts for the engines on the diesel locos. Would you then design a new diesel loco in today's world? Not really in a green environment, in a National Park. Economically, if you can save 50% of your fuel and your brake pads and you don't drip oil on the track up the mountain that's a good thing anyway, isn't it?"

Future plans

Clayton is currently gaining feedback for plans that could see it offering low-emission locos to mainstream rail operators. "We're offering a different concept for a more main line loco," said Hannaford. "There's some resistance to the concept because it's different, but I can do it for 60% of the price

drive down the emissions. They still want to reduce the overheads, the running costs. They still want to have less maintenance and all that sort of stuff. So I think there are some people in the market who actually realise what they need to do, particularly in the depots where there are built-up areas and noise is an issue, or emissions and things like that. The market is being dictated by regulations up to a point, but then it's being driven as well by some customers.

"If you're buying a loco to lease out for 30 years, you want to make sure that loco is still going to run legally in 30 years' time. You don't want to buy a stage IIIB emission diesel loco now and know in ten years' time you won't be part of the network. You want to future-proof your asset and we can offer that future-proofing. We design it so you can take that bit out and put another bit in and you don't have to do a major overhaul. It's not a big redesign, it's a plug and play modular system. It's not a situation where if a motor goes obsolete a whole wheelset has to come out. No. You keep the wheelset. You just change the motor. So the way we design is a bit different as well."

Hannaford believes the company's modular approach could pave the way for it to make a comeback as a supplier of motive power for the national rail network. "There are some traditional mindsets that say it must be like this because that's how we've done it and it's proven. It works. However, if that's the case you'd still be building steam locos. So at some point something's got to give. The shift from diesel to low emission is being forced on people. So if you want a main line loco like a Class 66 you cannot take a Class 66 and make it Stage V compliant. You just can't. There's just not enough space, particularly for the UK gauge. So something else has to be done.

"If you want low emissions, not everywhere around the UK is electrified so something else has to be used. So we've approached a few things and a few people. Sparked their interest. We've got that flexibility because we're small enough to say, 'we'll do this'. We'll look at the engineering problems and come up with a solution. A blank bit of paper. What do you want? How are you going to do it? We then design it to the requirements - not the other way around." **RI**

you're normally paying. It'll probably save you 60% of your running costs so it's got a lot of benefits, but I just know the questions will be: 'What have you done before? How many are running around the world?' But if you want the benefits of 60% of the price and 60% of running cost savings it's a chance you take. That's what we're currently running with. Not necessarily just for the UK, but overseas as well."

He expresses a frustration that certain sectors of the market can be rather judgmental when it comes to dealing with manufacturers such as Clayton, simply because they haven't produced the exact product before - even though they can prove the necessary expertise. Hannaford added: "The leasing companies I think are more open. They see the opportunity because they're first to market and can offer something no-one else can offer. They can offer a cheaper loco at a lower leasing price, so they still get their revenue, but it's better for the customer. They've still got to



RIGHT: One of Clayton's Co-Co rubber-tyred mining locos. (Clayton)