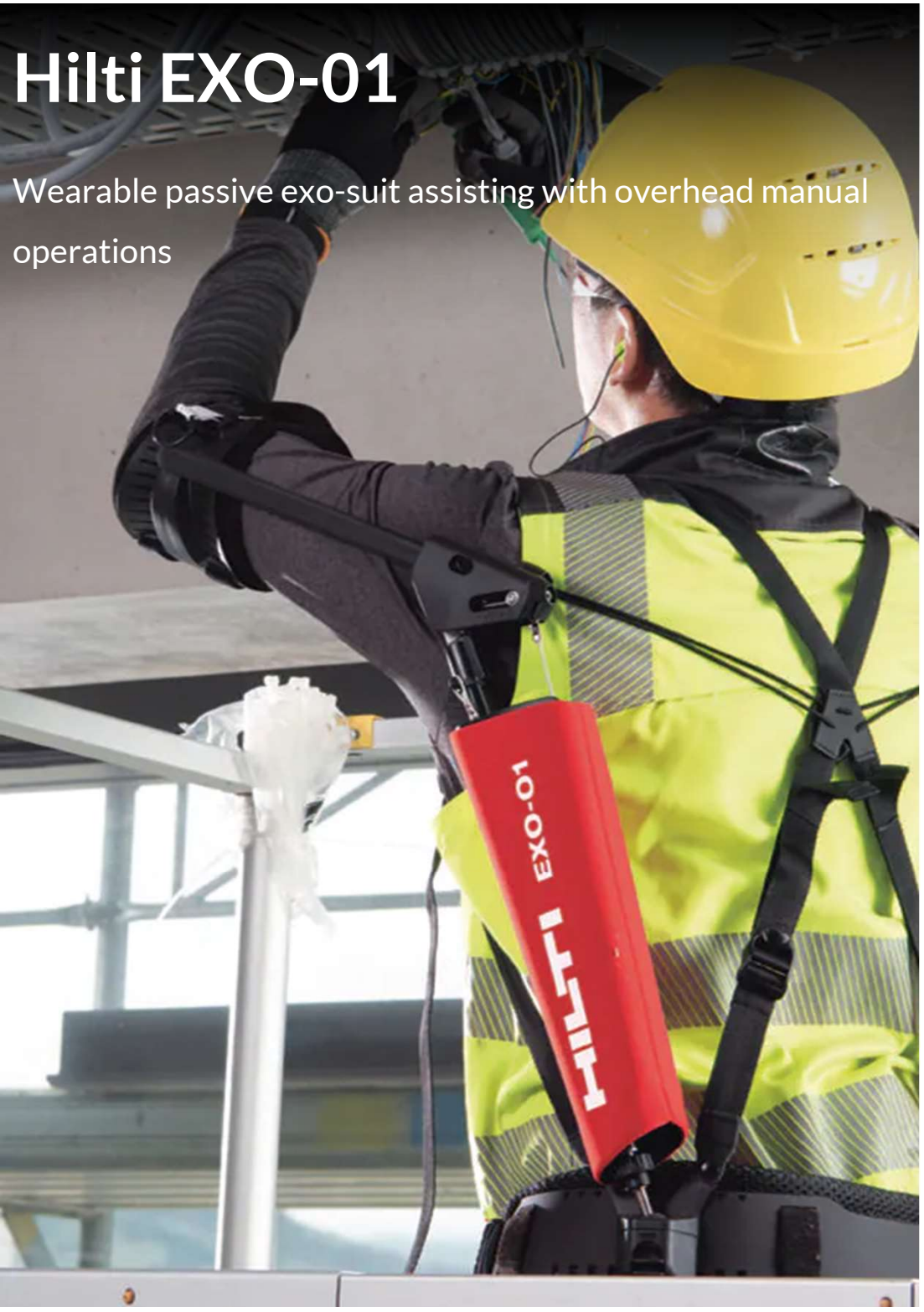
Hilti EXO-01

Wearable passive exo-suit assisting with overhead manual operations



Manufacturer	Hilti and Ottobock
Galliford Try Business Unit	Building North West
Site of testing	Smithfield One and Vimto Gardens, Manchester
Price	£1500 to purchase, £62/month to hire

The Hilti EXO-01 is a passive exoskeleton suit designed to be worn by operatives to assist in work wherein arms are held at shoulder or above head height for prolonged periods of time. The product research undertaken showed a marked improvement in productivity on site, with operatives able to work holding their arms and tools above their heads for prolonged periods of time, however at least two operatives were required for the initial fitting of a device, and some members that tested the EXO-01 felt there were downwards resistance issues when lowering their arms. These factors could be mitigated through more thorough calibration of the equipment per individual, and thus the equipment is recommended for use on site.

Key Findings and Recommendations

- Increase in productivity of 20% across all operatives involved in testing due to improved efficiency and capability when working with tools at or above head height
- Suitable for Plastering, Aftercare, Soffits, dry liners fixing boards or panels, electricians installing an array of equipment into ducts and vents, pipework and many other activities
- Limited by loss of blood flow to the arms and hands when held above head-height

Background Information

The EXO-01 is a wearable passive exoskeleton designed to assist the user in supporting the weight of their arms and/or tools when working at shoulder and over-head height. Hilti are the first tooling company to bring such equipment to the market, with the added benefit of medical prosthetic specialism from Ottobock.

The passive aspect of the suit refers to the fact that it does not use motorised assistance, rather a combination of elastic webbing along pulleys and cables to give support to the upper body. This passive assistance works with the bodies natural movement and strength in order to provide additional upward resistance when working with raised arms at shoulder height and above, combatting build up of lactic acid and resulting fatigue.

According to the Health and Safety Executive, nearly 500,000 construction operatives reported work-related muscular-skeletal disorders in 2018/19, with 41% of these related to upper limbs and neck. This product from Hilti is designed to mitigate this.

Methodology

Two projects in Manchester were chosen as testing sites, the Smithfield One in the city centre, a reclad of an existing high-rise building and the Vimto Gardens, a residential project. The sites were used due to a proportion of work being undertaken by cladders and scaffolders involving holding and fixing material at and above head height. Work undertaken included cleaning balcony soffits with cordless power-tools, erecting scaffold and fixing finishes onto surfaces. Difficulties in establishing a productivity metric due to the subjective use and opinions of the EXO-01 meant that the data reported represented the subjective views of those operatives whom used it, as well as the GT staff observing.

Findings

Overall, positive feedback was given across the two sites regarding a reduction in fatigue when working above head-height, specifically on vertical surfaces, however when lowering equipment, and working at heights below the eyeline, downward resistance from the skeleton was reported., leading some operatives to feel they had to 'work against' the suit in order to overcome this.

It was found that after an initial second operative assisting with the fitting, the suit can thereafter be applied and worn alone, with the tension provided able to be manually self adjusted in accordance with the specific tasks, and the size and strength of the operative, with higher tension providing more support in tasks but also more resistance when lowering arms. Whilst the suit did assist with raised arms, lack of blood flow to the extremities showed to be limiting.

Operatives also ensured to highlight potential issues when working in confined spaces due to the added bulk of the EXO-01, however this was overcome by carrying the equipment to the work location before fitting it, showing high portability. It was also shown that the exo-suit can work in tandem with additional kit such as harnesses, provided the harnesses are fitted beforehand.

Conclusions

Whilst the benefits from the equipment were seen, it needs noting that the equipment is best suited to relatively repetitive tasks at or above head height, such as those mentioned prior. A key takeaway from several operatives was feeling that the EXO-01 was working against them when arms were lowered, and upon investigation it was found that this could be improved by working in pairs for easier initial adjustment of tension settings to reach a level of comfort. This calibration would need to be carried out each time a new operative used the equipment

To conclude, from the trials carried out across the two sites and the experiences of those who used it, the EXO-01 is recommended for wider use across the GT business. With the correct guidance and setup, the equipment can potentially reduce upper-body fatigue injuries leading to a lower rate of long-term skeleto-muscular issues for operatives and a reduction in lost-time due to illness, whilst bolstering productivity on site.