

# HYDRAULIC ANKLE JOINT ENERGY STORAGE FOOT BOARD



What is a hydraulic ankle unit? Its hydraulic ankle unit allows the foot to adapt to uneven terrain and slopes for greater flexibility and comfort. Designed for optimal outcomes: Hydraulic ankle allows up to 2 degrees dorsiflexion and 10 degrees plantarflexion for a total range of 12 degrees.



How many degrees can a hydraulic ankle flex? Hydraulic ankle allows up to 2 degrees dorsiflexion and 10 degrees plantarflexion for a total range of 12 degrees. The dorsiflexion and plantarflexion adjustment valves allow resistance to be optimized to the individual user needs. Dorsiflexed position during swing phase for improved toe clearance.



Are hydraulic ankle-Feets better than non-hydraulic feet? Multiple independent scientific studies, comparing Blatchford hydraulic ankle-feet to non-hydraulic feet, have shown: Over a decade after challenging conventional wisdom, new scientific evidence continues to be published on the medical advantages of hydraulic ankles.



What are the different types of ankle foot systems? These four configurations included the participant's current flexible keel (FK) prosthetic foot, an energy-storage-and-return foot (ESAR), a hydraulic ankle (HA), and a microprocessor ankle (MPA). After a 2-week accommodation period, both patient-reported and performance-based outcome measures were recorded for each ankle foot system.



Are hydraulic- and microprocessor-controlled prosthetic ankles useful for limited community ambulators? However, the potential benefits of these devices have not been evaluated among patients classified as household or limited community ambulators. This study examined the benefit of hydraulic- and microprocessor-controlled prosthetic ankles for patients classified as limited community ambulators.

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Are microprocessor- and hydraulic-controlled prosthetic components better than fixed-ankle Esar and FK feet? The results show varying benefits of the microprocessor- and hydraulic-controlled prosthetic components over fixed-ankle ESAR and FK feet, based on both performance-based and patient-reported outcome measures. Further studies are needed to fully evaluate these benefits in larger sample sizes.



There are different alternatives when selecting removable prostheses for below the knee amputated patients. The designs of these prostheses vary according to their different functions. These prostheses designs can be classified into Energy Storing and Return (ESAR), Controlled Energy Storing and Return (CESR), active, and hybrid. This paper aims to identify ???



The ankle joint is one of the important joints of the human body to maintain the ability to walk. Diseases such as stroke and ankle osteoarthritis could weaken the body's ability to control



Researchers can now utilize new materials to create innovative models for lower limb prostheses and explore novel ways to use them for efficient dynamic control. To achieve user-friendliness, one area of research focuses on recovering and reusing kinetic walking energy for dynamic control. This paper proposes a new design for a magnetorheological (MR) valve, ???



hydraulic, articulating ankle joint, to allow a degree of damped joint movement in combination with spring deformation. The resulting viscoelastic behavior compensations, compared to conventional, energy-storage-and-return (ESR) feet.<sup>18</sup> In terms of loading, hydraulic ankle-feet reduce asymmetry on level<sup>19,20</sup> and uneven<sup>20</sup> walking surfaces

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Outdoor dynamic subject-specific evaluation of internal stresses in the residual limb: Hydraulic energy-stored prosthetic foot 34 compared to conventional energy-stored prosthetic feet Prosthetic-limb ankle kinetics, energy storage and return when using a hydraulic ankle device in unilateral trans-tibial amputees 35



Introduction. Walking on sloped surfaces is a common task in daily life. According to gait studies with able-bodied subjects, the knee joint has been found to be a major adaptor for slope ambulation as it provides additional flexion and extensor moment in the early and mid-stance phase compared to level ground walking [1???4].Currently most trans-femoral ???



Bo-Wen Li et al. ?4? Cip pump Internal Leakage Coefficient  $1.46 \times 10^{-3} \text{ m}^3/(\text{Pa} \cdot \text{s})$  Km ipMotor velocity-torque coefficient 1160rpm/Nm t Kf Pump Pressure-based Friction Coefficient  $1.07 \times 10^{-3} \text{ Nm/bar A}$



When the results are assessed together for the all participants as a collective whole, then all the categories showed an improvement. The domain showing the smallest level of improvement was "well-being," with an increase of 7.2% ( $p = 0.08$ ).This was followed by "transferring" and "utility," which registered increases of 12.5% ( $p = 0.02$ ) and 12.3% ( $p = 0.005$ ), respectively.



Passive prosthetic feet struggle to reproduce the human biological ankle range of motion and push-off. We propose the Hybrid-Hydraulic Ankle Prosthesis (H2AP), a prosthetic foot that provides a

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One of these conditions was the ankle-foot device. This included an energy-storage-and-return foot rigidly attached to the prosthetic pylon (RA ??? Esprit I, Endolite, Basingstoke, UK), while the other was a hydraulic ankle with a torsional adaptor (HA ??? EchelonVT II, Endolite, Basingstoke, UK). The second condition change was at the



Some of these devices use springs and/or bumpers to store and release energy and return the device's ankle joint to its equilibrium angle. This approach can result in good function on level terrain when using shoes of one particular heel height. (HYDRA) with a dynamic-response foot and hydraulic ankle with adjustable damping.



The first foot to introduce this concept, the Echelon foot, is a dynamic carbon fiber foot comprising independent toe and heel springs with a double cylinder hydraulic self-aligning ankle. 24 Since then, many design variations have been created with additional features such as an integrated shock module, 25 a device with integrated dorsiflexion

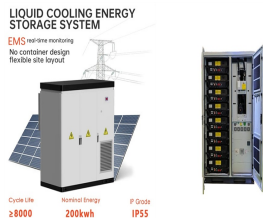


This study aimed to evaluate the kinematics and kinetics of the lower limb in both the intact and amputated leg in individuals with transtibial amputations wearing Energy storage and return feet (ESRFs) with fixed ankles and Prosthetic feet with adaptive ankles (PFAAs) during level walking. Three individuals with transtibial amputations walked on level ???



[155]-Hydraulic Pressure Energy Storage. Prosthetic Foot Wang Zitong. Ankle/Foot Hydraulic ESAR [162]-Prosthetic Ankle Joint Mechanism Moser David. Ankle Hydraulic Hybrid [163]

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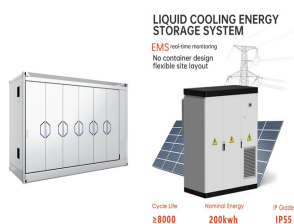
Another concept is to actively control an integrated ankle joint by adapting hydraulic plantar- and dorsiflexion resistances to the terrain to Wezenberg D, Cutti AG, Bruno A, Houdijk H. Differentiation between solid-ankle cushioned heel and energy storage and return prosthetic foot based on step-to-step transition cost. J Rehabil Res Dev



Its hydraulic ankle unit allows the foot to adapt to uneven terrain and slopes for greater flexibility and comfort. Designed for optimal outcomes: Hydraulic ankle allows up to 2 degrees dorsiflexion and 10 degrees plantarflexion for a total range of 12 degrees. Considering the hydraulic unit plus the carbon base the total ROM is:



This allows for precise control of energy storage and release, significantly improving the energy efficiency of the system. The active dorsiflexion stage: the driving force provided by single-rod hydraulic cylinder for the ankle joint prosthesis, and the force exerted on the ankle joint by the swinging of the lower leg during walking.



A novel hydraulic actuation mechanism, which can integrate the advantages of various actuation systems, is proposed to meet the required impedance characteristics of AFPs in this paper and can improve the efficiency while achieving a compact size and light weight. Ankle-foot prostheses (AFP) are devices commonly used for transtibial amputees to recover their ???



we designed a 3DP AFO with function of energy-storage, named Energy-Storage 3D Printed Ankle-Foot Orthosis (ESP-AFO), to suppress drop-foot and improve the walking efficiency of users [26]. In this study, we verify the effectiveness of the ESP-AFO in aiding stroke patients walk and compared it with the traditional AAFO. 2 Methods 2.1 Participants

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Previous research has shown that use of a dynamic-response prosthetic foot (DRF) that incorporates a small passive hydraulic ankle device (hyA-F), provides certain biomechanical benefits over using a DRF that has no ankle mechanism (rigA-F). This study investigated whether use of a hyA-F in unilateral trans-tibial amputees (UTA) additionally ???



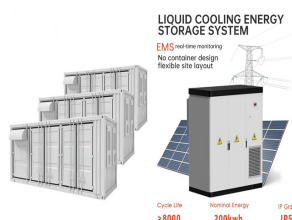
Energy storing and return (ESAR) feet are generally preferred over solid ankle cushioned heel (SACH) feet by people with a lower limb amputation. While ESAR feet have been shown to have only limited effect on gait economy, other functional benefits should account for this preference. A simple biomechanical model suggests that enhanced gait stability and gait ???



The EHA powered ankle prosthesis used in this study is an improved successor to the throttle-based MK-I tethered prototype developed by our group. As shown in Fig. 1(a), the sole is designed referring to the Flex-Foot [8], a passive carbon ???ber made structure absorbing the ground contact shock to the amputee while storing part of the energy



For example, the majority of passive prosthetic ankle- 66 foot components, such as energy storing and return prosthetic feet (e.g., Variflex), do not 67 incorporate an articulating ankle joint [13].



A passive mechanism for decoupling energy storage and return in ankle???foot prostheses: A case study in recycling collision energy Hashim A. Quraishi<sup>1,2,3</sup>, Max K. Shepherd<sup>3,4</sup>, ankle joint rotation. Higher energy storage in the spring results in a largernormal force between the cam



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Energy cost of ambulation in trans-tibial amputees using a dynamic-response foot with hydraulic versus rigid ankle?: insights from body centre-of-mass dynamics. J Neuroeng Rehabil . 2019 Mar 14;16(1):39. Download Bai X, Ewins D, Crocombe AD, Wei X. Kinematic and biomimetic assessment of a hydraulic ankle/foot in level ground and camber walking.



much energy amputees use when walking on slopes by analysing the oxygen and carbon dioxide in their breath<sup>11</sup>. Subjects were asked to walk on different gradients of slopes using rigidly-attached ESR feet and Blatchford's Echelon hydraulic ankle. With hydraulic ankles, they used an average of 20% less energy across the different slopes.



The resulting viscoelastic behaviour has been shown to allow better compliance and reduction of socket interface loads<sup>17</sup> when standing and walking on ramped surfaces, with fewer kinematic compensations, compared to conventional, energy-storage-and-return (ESR) feet. <sup>18</sup> In terms of loading, hydraulic ankle-feet reduce asymmetry on level <sup>19,20</sup>



Freedom Innovations, LLC developed the Kinnex<sup>???</sup> microprocessor controlled hydraulic ankle to address limitations of fixed ankle prosthetic systems. The Kinnex<sup>???</sup> is comprised of a graphite foot module, electronic sensors, and a hydraulic single-axis ankle with microprocessor control. A joint rotation sensor,



Hydraulic feet are renowned for increasing ground contact. The Odyssey K3 utilizes the patented curved hydraulic ankle plus a higher frequency carbon fiber foot base for increased dynamic response. The robust ankle housing and angular positioning was designed for moderate impact users able to balance without assistance.