MECHANICAL TENSILE MACHINE RESEARCH REPORT

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Hydraulic Jack

Side view

Grip

Front view

This is merely an example of a possible assembly configuration for the machine. Dimensions, components, and the layout can be modified or rearranged as needed.

Executive Summary

The mechanical tensile testing device is designed to offer a robust and simple solution for material testing. This device forgoes electronic complexity in favour of mechanical operations, utilizing a hydraulic jack for force application and a crane scale for measuring the force, providing a cost-effective alternative to electronic systems.

Technical Summary

The mechanical tensile testing device is engineered to be manually operated, replacing electronic actuators with a hydraulic jack. The device will also integrate a crane scale to measure the force applied to the material under test, and the data will be manually recorded for analysis.

Materials and Cost*

The following is an estimate based on current market prices (USD) for some components:

- 8x **Metal Round Bar Rods:** $20 - $60 each.
- 4x **Hot Rolled Steel Plates:** $50 - $150 each.
- **Miscellaneous (nuts, bolts, brackets):** $20 - $30.
- **Hydraulic Jack**: $20 - $100.
- **Digital Crane Scale**: $40 - $150.
- **Mechanical Fixtures and Specimen Holders:** $11 - $80.

*These are estimated prices; actual costs will depend on many factors such as the specific types of materials used, the measurement method, the test type and more.

Links

https://www.amazon.ca/s?k=Hot+Rolled+Steel+Plate&i=industrial&crid=111AU9BZUTUX0&sprefix=hot+rolled+steel+plate%2Cindustrial%2C120&ref=nb_sb_noss_1

https://www.amazon.ca/s?k=500mm+Length+metal+Rod+Bar

https://www.amazon.ca/s?k=Digital+Crane+Scale&i=industrial&crid=17UCHDD0EVWNW&sprefix=digital+crane+scale%2Cindustrial%2C75&ref=nb_sb_noss_1

https://www.amazon.ca/s?k=Hydraulic+Jack&crid=AWBJHZKIDIIP&sprefix=hydraulic+jack%2Caps%2C130&ref=nb_sb_noss_1

https://www.amazon.ca/s?k=Mechanical+Fixture&crid=HIZFZISEPNG9&sprefix=mechanical+fixture%2Caps%2C84&ref=nb_sb_noss_2

Timeline

Component Acquisition: 1 - 2 weeks for ordering and delivery of components.

Assembly: 1 week for assembly, mechanical adjustments.

Calibration and Testing: 4 days for calibration of the crane scale and initial testing.

Base frame Assembly

- Begin by fastening four round metal bars to one hot-rolled steel plate to create the bottom layer of the frame.
- Space and secure a second steel plate on top of these bars to complete the lower frame structure.
- In the centre of the first steel plate at the bottom, install a mechanical fixture.
- Place an automotive hydraulic jack beneath the second metal plate in the lower frame.

Upper Frame Construction

- Construct the upper frame similarly to the lower frame, using four round metal bars and two steel plates.
- Ensure the mechanical fixture is attached beneath the centre of the top first metal plate.
- Position the automotive hydraulic jack above the second metal plate in the centre, finalizing the upper frame.

Safety and Stability Checks

- Confirm that all bolts are tightened, and the frame is secure.
- Inspect the mechanical fixture and hydraulic jack for proper placement and secure attachment.
- Verify the entire assembly is stable and ready for use.

Testing and Calibration

- Test the mechanical fixture and hydraulic jack for smooth operation.
- Check that the hydraulic jack operates without obstruction and maintains pressure.

Final Setup and Operation

- Secure any test materials or components within the mechanical fixture.
- Ensure the hydraulic jack is accessible and functional for lifting or applying force.
- Record any measurements or observations necessary for operation and analysis.

Risk Assessment

Potential risks include mechanical failure, force measurement inaccuracies, and misalignment, which could result in incorrect measurements. Mitigation will involve rigorous testing, the selection of high-quality, durable components, and potentially the use of alignment aids.

Conclusion

The mechanical tensile testing device will serve as an invaluable tool by offering a quick and cost-effective solution for assessing material properties. With an estimated total material cost of under $350 and a projected completion time of approximately one month, the device is poised to be a practical addition to material testing capabilities. Nevertheless, the precision of the measurements could be a concern. To ensure stability and enhance measurement accuracy, it is essential for the two frames to be perfectly aligned. This may require the use of a lase or LED alignment system, to facilitate the process.