

Diagnostic Approach and Troubleshooting of Low Power Hoist Dump System in Komatsu HD 785-7

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ABSTRACT

The Komatsu HD785-7 is a widely utilized off-highway dump truck in large-scale mining operations, renowned for its high reliability and advanced hydraulic systems used to operate the dump body. However, one of the most critical and recurrent operational issues is low hydraulic power in the hoist system, which can severely disrupt material transportation efficiency. This study employs the Eight-Step Trouble Analysis Process to systematically diagnose and resolve the low power issue affecting the hoist dump mechanism. The methodology includes developing a troubleshooting chart, identifying potential causes, conducting field observations and diagnostics, collecting operational data, and performing root cause analysis. The investigation revealed that the primary cause of the malfunction was a degraded or out-of-specification Electronic Pressure Control (EPC) solenoid valve. The faulty EPC solenoid resulted in insufficient hydraulic pressure being delivered to the hoist cylinder, thus impairing lifting performance. Replacing the solenoid restored the hydraulic system to its optimal operational state. This research demonstrates that a structured diagnostic approach is essential for effective fault resolution in heavy-duty mining equipment. It offers practical insights for field technicians and engineers aiming to enhance reliability, minimize equipment downtime, and support preventive maintenance strategies in the mining sector.

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Introduction

The Komatsu HD785-7 stands as a pivotal piece of machinery in the mining sector, recognized for its durable construction and intricate hydraulic systems that facilitate the operation of its dump body [1]. However, a prevalent operational challenge encountered with these trucks is the diminished hydraulic power in the hoist system, which consequently hampers the efficiency of material transportation [2]. Addressing such operational impediments demands a meticulous and structured diagnostic protocol to accurately identify the fundamental cause and apply appropriate remediation strategies, thereby restoring the system's intended functionality and operational capacity [3]. The complexity of hydraulic systems in

heavy machinery mandates a systematic and interdisciplinary approach to troubleshooting, integrating expertise from various domains such as hydraulic engineering, electrical systems, and mechanical components to ensure minimal downtime and optimal performance, emphasizing the importance of a holistic understanding of the equipment's operational parameters and design specifications, ensuring a comprehensive and effective resolution of the identified issues. A performance evaluation of the equipment is essential to identify the root cause of failures, often involving a team of experts from both the operator and service company, and can lead to the implementation of technological solutions to address the identified problems [4].

To effectively tackle the challenge of low hydraulic power in the hoist dump system of the Komatsu HD785-7, a structured diagnostic protocol

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based on the Eight-Step Trouble Analysis Process is employed, which serves as a robust framework for systematically identifying and resolving intricate technical issues in heavy-duty machinery. Initially, a comprehensive troubleshooting matrix is developed, operating as a visual and logical navigational instrument that meticulously correlates potential failure modes with specific diagnostic test procedures and their respective corrective actions [5]. Instead of merely guiding technicians, this chart functions as an advanced expert system, facilitating a data-centric diagnostic process through the fusion of system schematics, sensor data interpretation protocols, and critical performance indicator benchmarks, thereby transforming raw data into actionable insights for precise fault isolation [6].

Following the construction of the troubleshooting chart, the subsequent phase encompasses the identification of potential causes, demanding a thorough evaluation of all system components that might contribute to the manifestation of low power in the hoist system [7]. This involves scrutinizing the hydraulic pump for indications of wear or cavitation, meticulously inspecting the hydraulic lines for any signs of leaks or blockages, assessing the integrity of the hoist cylinders for internal bypass, and evaluating the operational performance of control valves, particularly the Electronic Pressure Control solenoid valve, which plays a crucial role in regulating hydraulic pressure, highlighting the importance of considering both mechanical and electrical aspects in the diagnostic process [8].



Figure 1. Hoist Cylinder

The hoist cylinder on the dump body of the Komatsu HD785-7 unit is a vital component that functions to raise and lower the dump body during the loading and unloading process [9]. This system consists of several hydraulic cylinders designed to withstand heavy loads and operate under extreme conditions in mining environments, as shown in Figure 1.

Several studies have investigated faults in hydraulic systems, particularly those caused by electrohydraulic components such as Electronic Proportional Control (EPC) solenoids, which modulate oil pressure and valve operation. One study by [10] analyzed pressure irregularities in the hoist system of off-highway trucks and identified degraded EPC coil resistance as a primary cause of slow or incomplete lifting. In a related investigation, [11] examined solenoid performance under varying thermal loads and found that excessive resistance drift caused by prolonged vibration could lead to valve opening failures [12].

Another study by [13] evaluated the impact of hydraulic fluid contamination on EPC-controlled systems and concluded that even minor particulate contamination could interfere with valve spool movement, reducing hoisting efficiency. Moreover, [14] proposed a model-based fault diagnosis system to monitor real-time deviations in hydraulic performance, which proved effective in early detection of power losses in mining trucks.

More recently, a comprehensive case study by [15] highlighted the relationship between solenoid resistance deviation and low-pressure faults in Komatsu trucks. Their findings confirmed that improper resistance values due to wiring issues or aging solenoids caused insufficient magnetic actuation of valves, disrupting the hydraulic flow to the hoist cylinders [16].

Despite these developments, case-based troubleshooting investigations involving Komatsu HD785-7 units in field conditions remain underrepresented in the literature. This study seeks to bridge that gap by reporting a practical diagnostic process performed at a coal mining site in East Kalimantan, Indonesia [18][19]. Using an 8-step troubleshooting framework, we identified the root cause of a low-power hoist dump fault in an HD785-7 unit as a result of EPC solenoid degradation. The study emphasizes the importance of resistance-based solenoid health monitoring and provides recommendations for predictive maintenance strategies in electrohydraulic systems.

Methods

To identify and resolve the low-power issue in the hydraulic hoist system of the Komatsu HD785-7 dump truck, this study adopted a structured and systematic troubleshooting approach widely applied in the heavy equipment maintenance industry. [20] The methodology is based on an eight-step fault diagnostic framework, ensuring logical progression from symptom identification to the implementation of corrective actions. This framework is illustrated in Fig. 1.



Figure 2. Flow Chart for 8 Step Troubleshooting

The process begins with referencing the manufacturer's troubleshooting chart, which maps common operational symptoms to potential component-level issues. From this initial review, a list of possible causes is formulated, focusing on both mechanical and electrohydraulic subsystems. The procedure then moves into the observational and diagnostic phase, where system behavior is assessed through visual inspection, performance evaluation, and control input testing [21].

Subsequently, relevant operational data is gathered through targeted inspection of hydraulic components such as valves, pumps, filters, cylinders, and electronic solenoids. These components are evaluated for functionality, fluid condition, and signal responsiveness using appropriate measuring tools and control test procedures [22].

The analysis stage involves interpreting the collected data in reference to Operations Maintenance & Manual (OMM) specifications, including standard pressure ranges, resistance values, and system response parameters [23][24]. This enables precise identification of anomalies that may indicate component degradation, improper control signaling, or hydraulic inefficiencies. Once the most likely cause is determined, a conclusion is drawn, followed by the execution of corrective action. This may involve component replacement, recalibration, or system reconfiguration to restore full operational performance [25].

Results and Discussions

The diagnosis of the low hoist power issue on the Komatsu HD785-7 dump truck began with a systematic analysis based on the unit's shop manual. The primary symptom observed was a lack of sufficient hydraulic force during the dump body lifting process, despite normal engine operation. This prompted the team to perform pressure testing on the hoist circuit.



Figure 3. Oil Cylinder Pressure Measurement

The pressure at the hoist system relief line was measured using a calibrated digital hydraulic pressure gauge. As illustrated in Fig. 2, the measured pressure was 147 kg/cm^2 , significantly below the standard range of $185\text{--}195 \text{ kg/cm}^2$ as specified in the manufacturer's shop manual. This deviation clearly indicated a deficiency in the hydraulic system's ability to generate proper lifting force.

To identify the root cause, further inspection was conducted on critical hydraulic and electrohydraulic components. The first inspection targeted the hydraulic oil level and filter strainer. As shown in Fig. 3, both the oil level and the cleanliness of the strainer were within acceptable operational limits, suggesting that oil starvation or contamination was not the primary issue.



Figure 4. Oil Level & Filter oil strainer

With all mechanical and fluid systems functioning properly, the investigation shifted toward the Electronic Proportional Control (EPC) solenoid, a critical actuator that regulates the hoist valve electronically. Electrical resistance tests were conducted on the solenoid connectors. The readings, summarized below, showed significant deviations from standard reference values.



Figure 4. EPC Hoist HEPC Solenoid Measurement



Figure 4. EPC Hoist HSOL Solenoid Measurement

Table 1. Measurement

Solenoid Type	Resistance (Male)	Resistance (Female)
HEPC Solenoid	7 Ω	6.08 MΩ
HSOL Solenoid	25 Ω	11 MΩ

These values were outside the acceptable resistance range indicated in the shop manual, as shown in Table 1, suggesting internal coil degradation, possibly due to thermal fatigue, vibration, or aging of the solenoid windings.

Table 2. OMM Standard

Component	Test Step	Test Point	Expected Resistance
Hoist EPC Valve Solenoid	1. Turn the starting switch OFF. 2.Disconnect connector HEPC. 3. Connect T-adaptor.	Between HEPC (male) (1) – (2)	15 – 20 Ω
		Between HEPC (female) (1), (2) – ground	Min. 1 MΩ
Hoist Lever Select Valve Solenoid	1. Turn the starting switch OFF. 2.Disconnect connector HSOL. 3. Connect T-adaptor.	Between HSOL (male) (1) – (2)	15 – 35 Ω
		Between HSOL (female) (1), (2) – ground	Min. 1 MΩ

The solenoid’s degraded performance would result in an insufficient electromagnetic force being generated, thus preventing the hoist valve from fully opening and restricting the flow of hydraulic oil to the cylinder. This was confirmed to be the primary cause of the hoist dump power loss.

After replacing the EPC solenoid, a follow-up pressure test was conducted. The hoist system pressure was restored to the standard range of 185–190 kg/cm², and the dump body resumed normal lifting performance. The corrective action verified that the failure originated from the EPC control circuit rather than mechanical or hydraulic elements.

Conclusions

A systematic diagnostic procedure was conducted to identify the root cause of a hoist dump low power issue on a Komatsu HD785-7 dump truck. Initial hydraulic pressure measurements indicated a significant deviation from the manufacturer's specified range, suggesting insufficient force delivery to the hoist cylinders. Mechanical inspections of key components including the hoist valve, demand valve, and hydraulic filter showed no signs of mechanical failure or contamination.

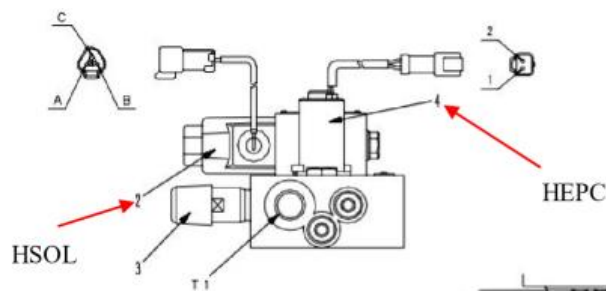


Figure 5. EPC Hoist Structure

Electrical diagnostics revealed abnormal resistance values in both the HEPC and HSOL solenoids of the Electronic Proportional Control (EPC) system. These deviations impaired solenoid actuation, resulting in incomplete valve operation and restricted oil flow. Replacement of the EPC solenoid restored hydraulic pressure to nominal values and resolved the hoist performance issue.

The results confirm that solenoid degradation within the EPC system was the primary cause of the fault. Regular monitoring of solenoid resistance and connector integrity is recommended as part of a preventive maintenance strategy to minimize downtime and maintain operational reliability in heavy duty mining applications.

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Author Contributions

Rasma, S.T., M.T.: Conceptualized the study, designed the experimental procedures, and conducted the primary data analysis. Provided critical insights into the failure mechanisms and developed the framework for the analysis.

Reza Febriano Armas, S.Pd., M.T.: Assisted in drafting and editing the manuscript, including figures and tables. Reviewed and contributed to the final revision and formatting of the paper.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper. All research and analysis were conducted with impartiality and without any external influence or financial interests that could have affected the outcomes. Any potential conflicts of interest have been disclosed, and the study adhered to ethical standards in research and reporting.

References

- [1] Wang, L., Zhao, D., Wang, Y., Wang, L., Li, Y., Du, M., & Chen, H. (2017). Energy management strategy development of a forklift with electric lifting device. *Energy*, 128, 435-446. <https://doi.org/10.1016/j.energy.2017.04.012>
- [2] Wodecki, J., Michalak, A., & Stefaniak, P. (2018). Review of smoothing methods for enhancement of noisy data from heavy-duty LHD mining machines. In *E3S Web of Conferences* (Vol. 29, p. 00011). EDP Sciences. <https://doi.org/10.1051/e3sconf/20182900011>
- [3] Ovchinnikova, N. I., Bonnet, V. V., & Kosareva, A. V. (2020, August). Simulation diagnostics of power train mechanical drives. In *IOP Conference Series: Earth and Environmental Science* (Vol. 548, No. 5, p. 052033). IOP Publishing. DOI 10.1088/1755-1315/548/5/052033
- [4] Pino, J. D., Martin, J. L., Gomez, S., Gonzalez, A., Paz, O., Izquierdo, S., & Sarkis, N. (2015, May). Electric submersible pumps (ESP) performance improvement by implementation of extreme performance motor technology in Caño Limon Field. In *SPE Artificial Lift*

- Conference-Latin America and Caribbean (pp. SPE-173915). SPE.
<https://doi.org/10.2118/173915-MS>
- [5] Fu, B., Zhu, T., Liu, J., & Hu, X. (2022). Research on Clamping Force Control of CVT for Electric Vehicles Based on Slip Characteristics. *Sensors*, 22(6), 2131.
<https://doi.org/10.3390/s2206213>
- [6] Cruzat, J. V., & Valenzuela, M. A. (2018). Integrated modeling and evaluation of electric mining trucks during propel and retarding modes. *IEEE Transactions on Industry Applications*, 54(6), 6586-6597.
DOI: 10.1109/TIA.2018.2854258
- [7] Snoy, J. B., Dundore, M. W., & Pelligrino, P. A. (1975). The TDMC-33-7002: A 1500 HP Transmission for Shuttle Type Vehicles (No. 750818). SAE Technical Paper.
<https://doi.org/10.4271/750818>
- [8] Mazumdar, J., Koellner, W., & Moghe, R. (2010, February). Interface issues of mining haul trucks operating on trolley systems. In 2010 Twenty-Fifth Annual IEEE Applied Power Electronics Conference and Exposition (APEC) (pp. 1158-1165). IEEE.
DOI: 10.1109/APEC.2010.5433357
- [9] Wu, G., Liu, F., & Xu, S. (2022). Compiling method of automobile fault diagnosis information. In MATEC Web of Conferences (Vol. 355, p. 03073). EDP Sciences.
<https://doi.org/10.1051/mateconf/202235503073>
- [10] Setiawan, B., Rasma, R., Ramadhan, A. I., Armas, R. F., Junaedi, T., & Hamisa, A. H. (2026). Mechanical Properties of Composite from Roving Fibre and Polyester Resin BQTN R157 Variations Manufactured using Vacuum Bagging Method for Unmanned Aerial Vehicle Applications. *Journal of Advanced Research in Applied Mechanics*, 137(1), 58-66.
- [11] Deur, J., Ivanovic', V., Petric', J., Hancock, M., & Assadian, F. (2008, January). A Control-Oriented Model of Hydrostatic Transmission With Application on Torque Vectoring Differential Modeling. In ASME International Mechanical Engineering Congress and Exposition (Vol. 48661, pp. 115-124).
<https://doi.org/10.1115/IMECE2008-67394>
- [12] Maguire, J. M., Peng, H., & Bai, S. (2013). Dynamic analysis and control system design of automatic transmissions. SAE International.
ISBN : 978-0-7680-7932-6
- [21] *Advanced Research in Fluid Mechanics and Thermal Sciences*, 118(2), 13-23.
- [13] Manring, N. D., Al-Ghraiiri, T. S., & Vermillion, S. D. (2013). Designing a hydraulic continuously variable-transmission (CVT) for retrofitting a rear-wheel drive automobile. *Journal of Mechanical Design*, 135(12), 121003.
<https://doi.org/10.1115/1.4025119>
- [14] Tanelli, M., Panzani, G., Savaresi, S. M., & Pirola, C. (2011). Transmission control for power-shift agricultural tractors: Design and end-of-line automatic tuning. *Mechatronics*, 21(1), 285-297.
<https://doi.org/10.1016/j.mechatronics.2010.11.006>
- [15] Armas, R. F., Aryadi, A., & Pratama, N. P. (2024). Design and Build Special Service Tools for Remove & Install Drive Shaft for Komatsu HD785-7 Dump Truck. *Jurnal E-Komtek (Elektro-Komputer-Teknik)*, 8(1), 199-206.
<https://doi.org/10.37339/ekomtek.v8i1.1857>
- [16] Rasma, R., Armas, R. F., Purwono, H., Setiawan, B., & Adnan, M. (2024, July). Analysis Abnormal of Engine Noise in UD Truck Quester CWE 370 Unit. In *International Conference on Engineering, Construction, Renewable Energy, and Advanced Materials*.
<https://jurnal.umj.ac.id/index.php/icecream/article/view/22826/10554>
- [17] Davidson, J. R., & Krebs, H. I. (2018). An electrorheological fluid actuator for rehabilitation robotics. *IEEE/ASME Transactions on Mechatronics*, 23(5), 2156-2167.
DOI: 10.1109/TMECH.2018.2869126
- [18] Ramadhan, A. I., Hendrawati, T. Y., Umar, E., Sari, A. M., Rahardja, I. B., & Firmansyah, F. Preparation and Characterization of Nano-Cellulose Powder from Oil Palm Empty Fruit Bunch as Green Nanofluids. *Nanoscience and Technology: An International Journal*. DOI: 10.1615/NanoSciTechnolIntJ.2024050024
- [19] Ramadhan, A. I., Umar, E., Azmi, W. H., & Sari, A. M. (2024). Heat transfer performance of Al₂O₃-TiO₂-SiO₂ ternary nanofluids in plain tube with wire coil inserts. *Mechanical Engineering for Society and Industry*, 4(1), 50-67.
- [20] Susanto, E., Fadri, M. F., Aulia, A., Ramadhan, A. I., & Azmi, W. H. (2024). Numerical Study on the Influence of Torque Performance Caused by Deflectors on Darrius Wind Turbines. *Journal of*

- <https://doi.org/10.37934/arfmts.118.2.1323>
- [22] Sari, A. M., Ramadhan, A. I., Rahardja, I. B., Umar, E., Yudistirani, S. A., Faisal, A. I., ... & Azmi, W. H. (2024). Effect of Mass Composition on Nano Zircon Synthesize from Local Zircon Sand Using Soda-Precipitation-Calcination-Caustic Fusion Method. *Jurnal Teknologi*, 16(2), 169-178.
<https://doi.org/10.24853/jurtek.16.2.169-178>
- [23] Suwandi, A., Rachmawanto, M. P., Libyawati, W., & Siregar, J. P. (2023). The Development of Exhaust Fan Housing With Ceiling Mounting For High Rise Buildings by Using DFMA. *Journal of Applied Engineering and Technological Science (JAETS)*, 4(2), 895-907.
<https://doi.org/10.37385/jaets.v4i2.1675>
- [24] Armas, R. F., Purwono, H., Junaedi, T., Alfauzi, A., & Santosa, L. F. (2024). Development of a Special Service Tool for Hydraulic Piston Maintenance on Excavator PC 210-10M0. *SINTEK JURNAL: Jurnal Ilmiah Teknik Mesin*, 18(2), 121-128.
<https://doi.org/10.24853/sintek.18.2.121-128>
- [25] Suwandi, A., Libyawati, W., & Mulatsari, E. (2024). The Impact of Modified Atmosphere Storage Treatment on Glucose Levels and Mass Transfer Coefficients: A Study Based on Fruit Skin Thickness. *Journal of Applied Engineering and Technological Science (JAETS)*, 5(2), 1142-1153.
<https://doi.org/10.37385/jaets.v5i2.3481>
- [26] Santoso, H. B., & Setiabudy, R. (2014). Development battery operation management to maintaining continuity operation of microgrids in islanding condition. *Journal of Theoretical and Applied Information Technology*, 65(2), 573-582.