

ABSTRACT

Piping systems are critical components in various industrial sectors, including oil and gas, chemical, and energy. The reliability and safety of the piping system is a key factor to prevent leakage or failure, some of the influencing factors are the schedule and the distance between the supports. This study raises the topic of stress analysis of CPO pipelines owned by PT Pelindo Multi Terminal at the Belawan stockpile tank facility, aiming to determine the value of stress that occurs and the relationship between variations in schedule values and support distances to stress values.

The stress analysis of this piping system includes schedule variations and the distance between supports based on the ASME B31.3 code standard. Through the data obtained, the pipe studied has a size of NPS 4 "SCH 40 with ASTM A106 B material. After the analysis of the pipeline is safe through sustainable loading, schedule variations (SCH 40, SCH 80, and SCH 120) and the distance between supports (1 meter, 2.5 meters, and 4 meters) are carried out.

The results show that the highest stress value that occurs is still below the allowable stress based on the ASME B31.3 code standard with a stress ratio value of 55.65. Simulation of sustainable loading of piping systems with schedule variations and the distance between supports left fixed under the same conditions results in a large decrease in the value of axial stress, bending stress, and torsional stress as the schedule value increases. Meanwhile, the simulation of piping system loading with variations in the distance between supports and schedule at a fixed condition causes an increase in the value of bending stress and torsional stress as the value of the distance between supports increases, but the variation in the distance between supports does not affect the value of axial stress.

Keyword: Pipe Stress Analysis, ASME B31.3, Pipe Schedule

INTISARI

Sistem perpipaan merupakan komponen penting dalam berbagai sektor industri, termasuk minyak dan gas, kimia, dan energi. Keandalan dan keamanan sistem perpipaan menjadi faktor kunci untuk mencegah kebocoran atau kegagalan, beberapa faktor yang memengaruhi ialah ketebalan dinding pipa (*schedule*) dan jarak antara penumpu. Penelitian ini mengangkat materi analisis tegangan jalur perpipaan CPO milik PT Pelindo Multi Terminal pada fasilitas tangki timbun Belawan, bertujuan untuk mengetahui nilai tegangan yang terjadi serta hubungan antara variasi nilai *schedule* dan jarak penumpu terhadap nilai tegangan.

Analisis tegangan sistem perpipaan ini meliputi variasi *schedule* dan jarak antara penumpu berdasarkan standar kode ASME B31.3. Melalui data yang diperoleh pipa yang diteliti memiliki ukuran NPS 4" SCH 40 dengan material ASTM A106 B. Setelah analisis jalur perpipaan aman melalui pembebanan *sustain*, maka dilakukan variasi *schedule* (SCH 40, SCH 80, dan SCH 120) dan jarak antara penumpu (1 meter, 2,5 meter, dan 4 meter).

Hasil penelitian menunjukkan bahwa nilai tegangan tertinggi yang terjadi masih di bawah tegangan izin berdasarkan standar kode ASME B31.3 dengan nilai rasio tegangan sebesar 55,65. Simulasi pembebanan *sustain* sistem perpipaan dengan variasi *schedule* dan jarak antara penumpu dibiarkan tetap pada kondisi yang sama menghasilkan penurunan besar nilai tegangan aksial, tegangan tekuk, dan tegangan torsi seiring dengan naiknya nilai *schedule*. Sementara itu, simulasi pembebanan sistem perpipaan dengan variasi jarak antara penumpu dan *schedule* pada kondisi tetap menyebabkan peningkatan besar nilai tegangan tekuk dan tegangan torsi seiring dengan naiknya nilai jarak antara penumpu, namun variasi jarak antara penumpu tidak memengaruhi besar nilai tegangan aksial.