Industrial Alarm System Analysis

1. Executive Summary & EEMUA Benchmarks

Analysis File: data/synthetic_alarms_5_patterns.csv

Time Range: 2024-05-01 00:04:25 to 2024-05-09 13:52:06

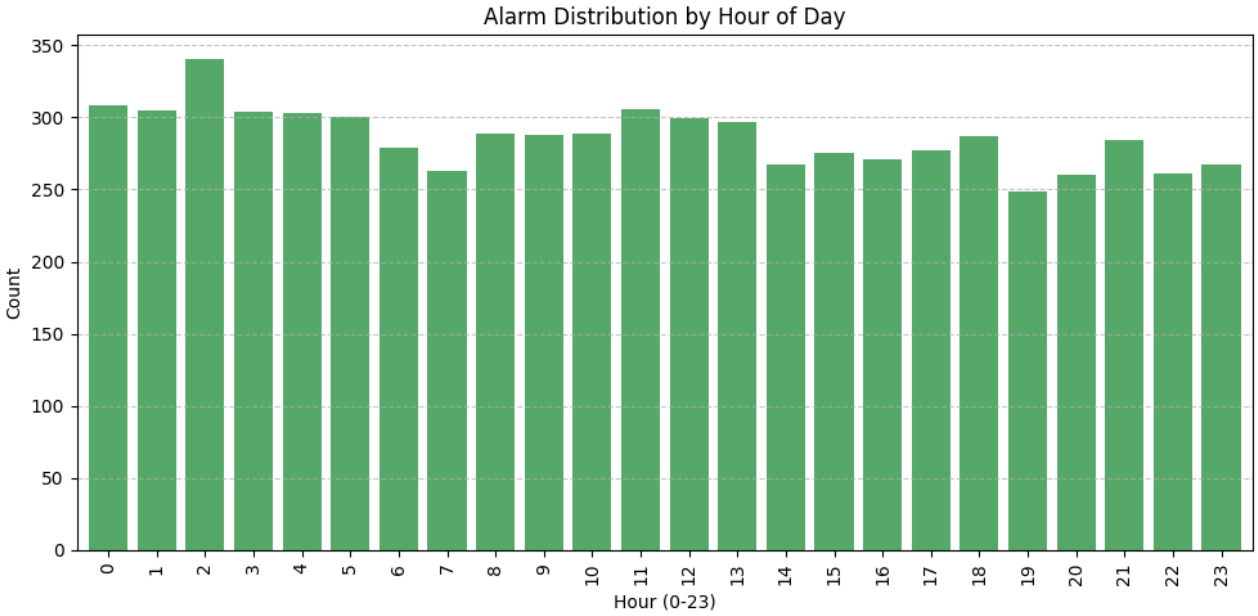
Total Alarms: 6868

System Health Status: OVERLOADED (Critical)

Avg Alarms per 10 mins: 5.56
Flood Intervals (>10 alarms/10min): 50 (4.0%)

2. Temporal Analysis & HDAP

Distribution of alarms by hour of day and High Density Alarm Plot.



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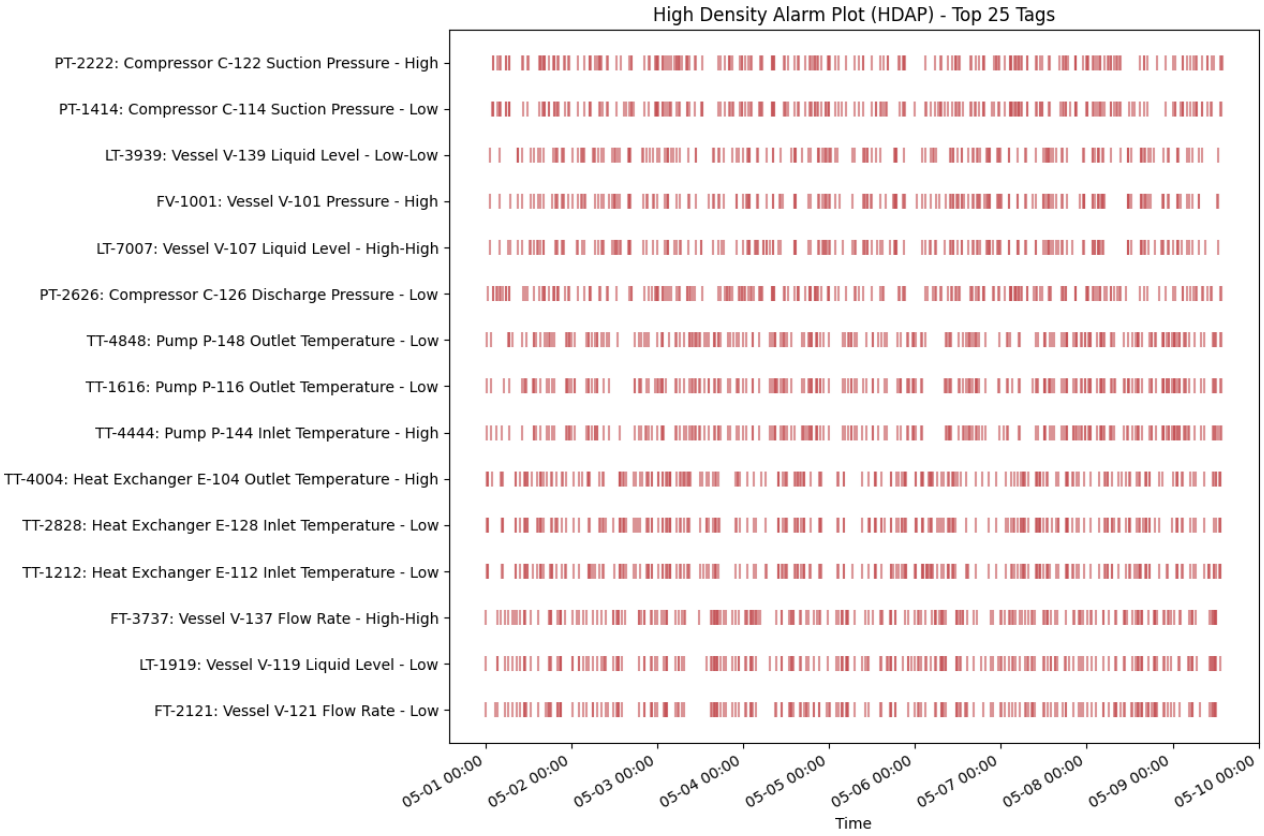
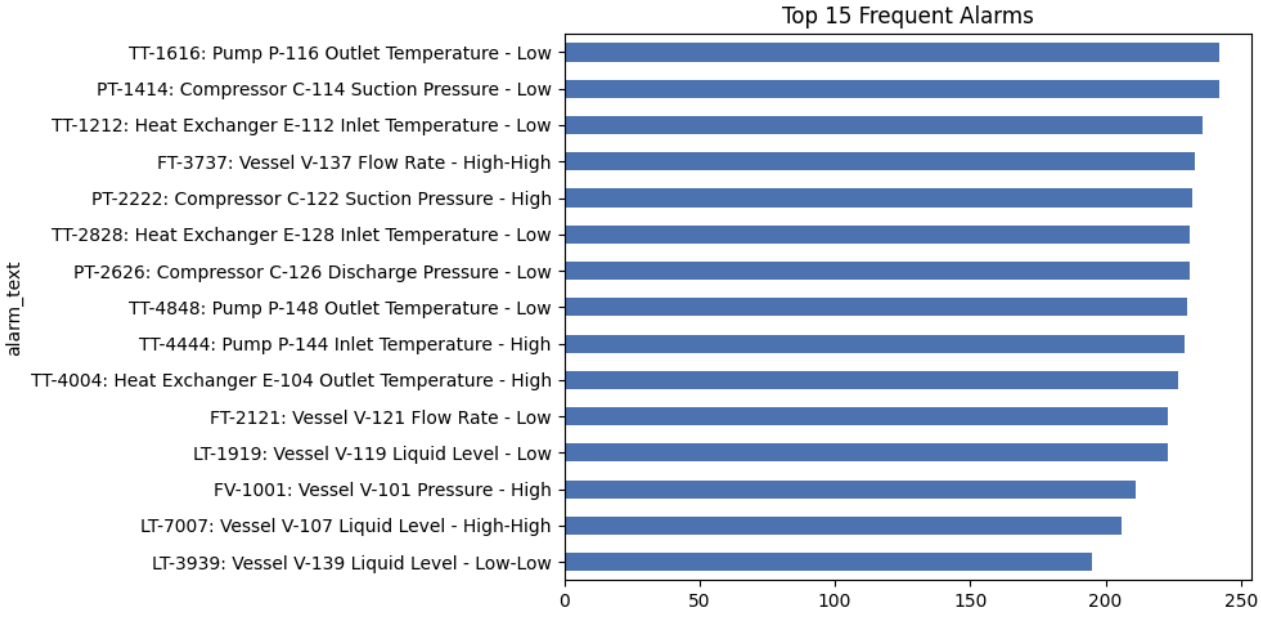


3. Top 15 Frequent Alarms



4. Alarm Chatter (Kondaveeti et al.)

Alarms with Index > 0.05 are considered CRITICAL (Machine-gunning).

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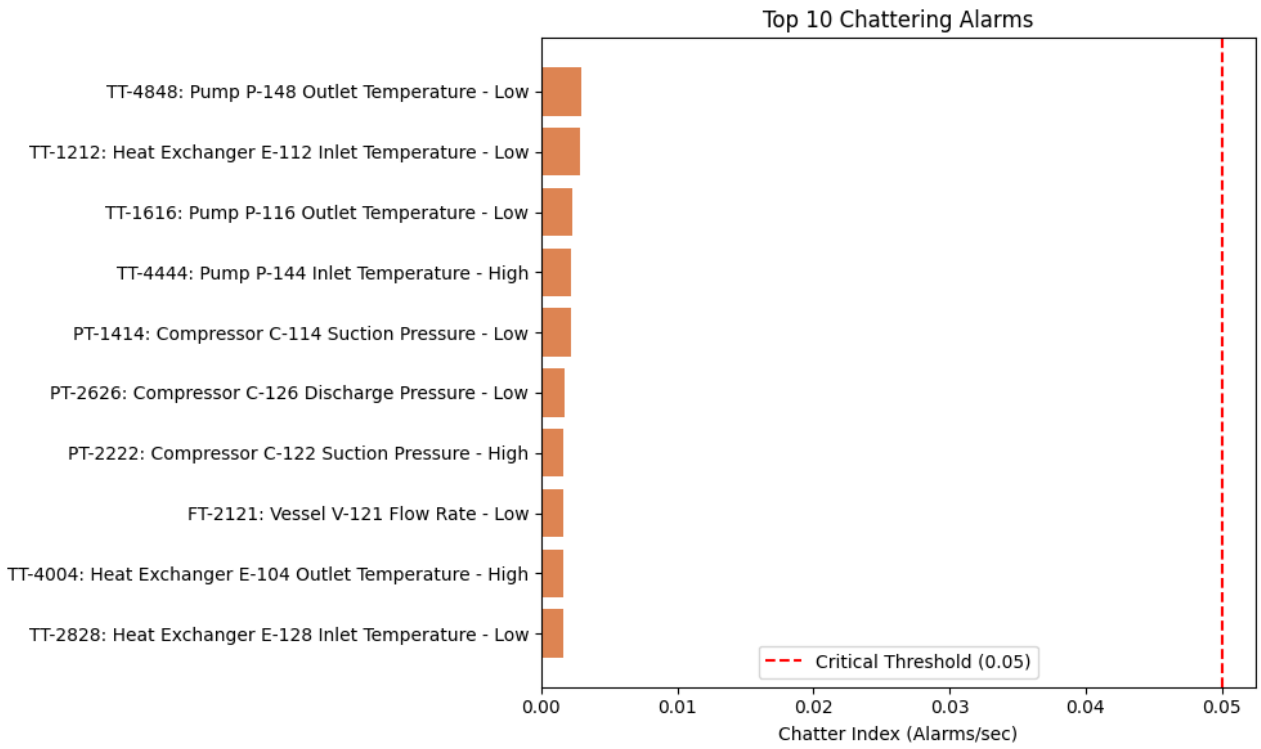

alarm_text	chatter_index	status
TT-4848: Pump P-1...	0.0029	Normal
TT-1212: Heat Exc...	0.0029	Normal
TT-1616: Pump P-1...	0.0023	Normal
TT-4444: Pump P-1...	0.0022	Normal
PT-1414: Compress...	0.0022	Normal
PT-2626: Compress...	0.0018	Normal
PT-2222: Compress...	0.0017	Normal
FT-2121: Vessel V...	0.0016	Normal
TT-4004: Heat Exc...	0.0016	Normal
TT-2828: Heat Exc...	0.0016	Normal

5. Co-Occurrence Patterns (FP-Growth)

Parameters: Window=5min, MinSupport=0.01

Support 7.9% : TT-1616: Pump P-116 Outlet Temperature - Low, TT-4848: Pump P-148 Outlet Temperature - Low

Support 7.9% : TT-4444: Pump P-144 Inlet Temperature - High, TT-4848: Pump P-148 Outlet Temperature - Low

Support 7.9% : TT-4444: Pump P-144 Inlet Temperature - High, TT-1616: Pump P-116 Outlet Temperature - Low, TT-4848: Pump P-148 Outlet Temperature - Low

Support 7.9% : TT-1616: Pump P-116 Outlet Temperature - Low, TT-4444: Pump P-144 Inlet Temperature - High

Support 7.7% : TT-1212: Heat Exchanger E-112 Inlet Temperature - Low, TT-4004: Heat Exchanger E-104 Outlet Temperature - High

Support 7.6% : TT-1212: Heat Exchanger E-112 Inlet Temperature - Low, TT-2828: Heat Exchanger E-128 Inlet Temperature - Low

Support 7.6% : TT-4004: Heat Exchanger E-104 Outlet Temperature - High, TT-2828: Heat Exchanger E-128 Inlet Temperature - Low

Support 7.6% : TT-1212: Heat Exchanger E-112 Inlet Temperature - Low, TT-4004: Heat Exchanger E-104 Outlet Temperature - High, TT-2828: Heat Exchanger E-128 Inlet Temperature - Low

Support 7.5% : PT-2626: Compressor C-126 Discharge Pressure - Low, PT-1414: Compressor C-114 Suction Pressure - Low

Support 7.4% : PT-2222: Compressor C-122 Suction Pressure - High, PT-2626: Compressor C-126 Discharge Pressure - Low, PT-1414: Compressor C-114 Suction Pressure - Low

Top Association Rules (Cause -> Effect)

LIFT 13.14 | LT-3939: Vessel V-139 Liquid Level - Low-Low -> LT-7007: Vessel V-107 Liquid Level - High-High, FV-1001: Vessel V-101 Pressure - High

LIFT 13.14 | LT-7007: Vessel V-107 Liquid Level - High-High, FV-1001: Vessel V-101 Pressure - High -> LT-3939: Vessel V-139 Liquid Level - Low-Low

LIFT 12.12 | LT-7007: Vessel V-107 Liquid Level - High-High -> LT-3939: Vessel V-139 Liquid Level - Low-Low, FV-1001: Vessel V-101 Pressure - High

LIFT 12.12 | LT-3939: Vessel V-139 Liquid Level - Low-Low, FV-1001: Vessel V-101 Pressure - High -> LT-7007: Vessel V-107 Liquid Level - High-High

LIFT 12.00 | FV-1001: Vessel V-101 Pressure - High -> LT-3939: Vessel V-139 Liquid Level - Low-Low, LT-7007: Vessel V-107 Liquid Level - High-High

LIFT 12.00 | LT-3939: Vessel V-139 Liquid Level - Low-Low, LT-7007: Vessel V-107 Liquid Level - High-High -> FV-1001: Vessel V-101 Pressure - High

LIFT 11.43 | LT-1919: Vessel V-119 Liquid Level - Low, FT-3737: Vessel V-137 Flow Rate - High-High -> FT-2121: Vessel V-121 Flow Rate - Low

LIFT 11.43 | FT-2121: Vessel V-121 Flow Rate - Low -> LT-1919: Vessel V-119 Liquid Level - Low, FT-3737: Vessel V-137 Flow Rate - High-High

6. Sequence Probability (Markov Matrix)

Heatmap showing the probability of 'Next Alarm' given 'Current Alarm'. Darker blue indicates higher probability.

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