

CLEEN

Cluster for Energy and Environment



efeu

Efficient Energy Use

Advanced use of variable speed
drives in compressor systems

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Tomorrow's Energy Efficiency Solutions Seminar

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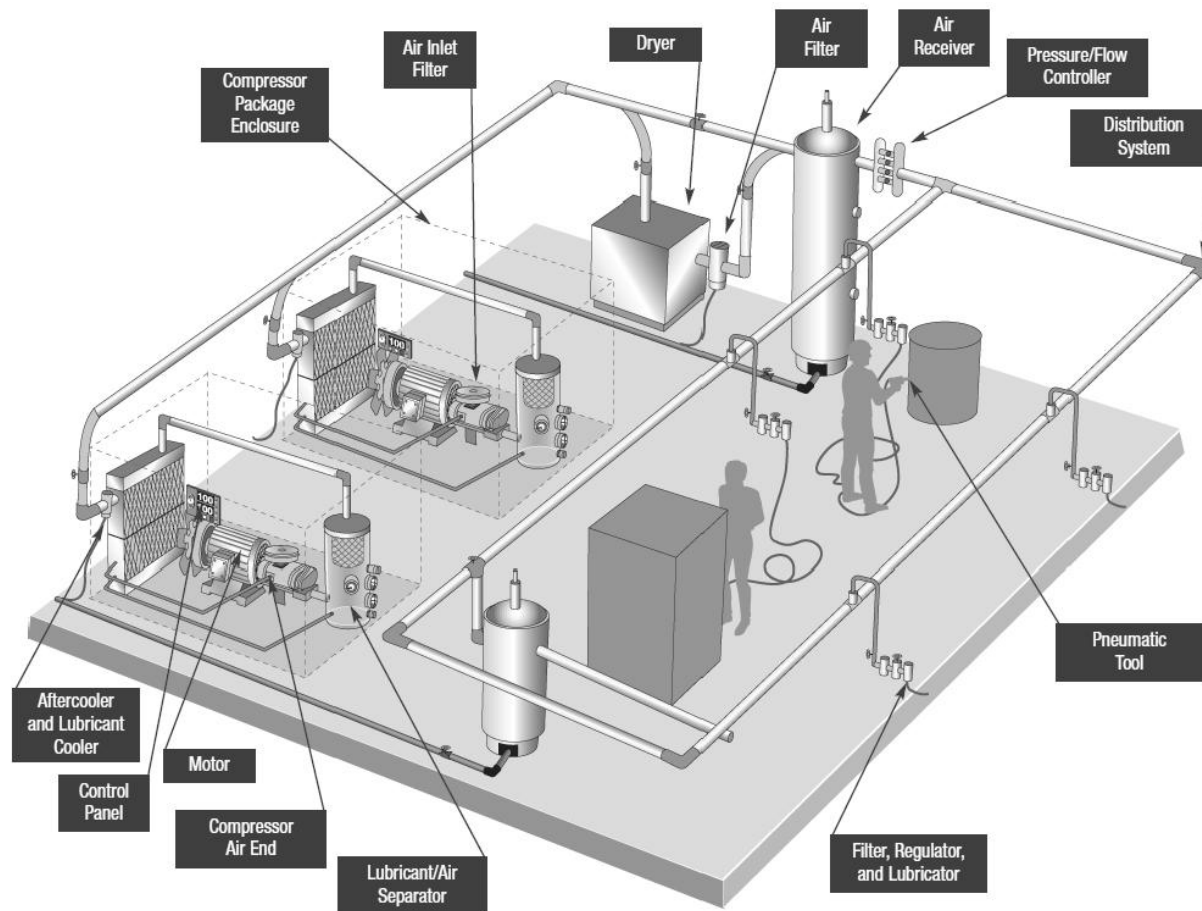


Introduction

- VSD-based identification and diagnostic methods for compressed air systems
 - Improve efficiency and maintenance
- EFEU WP2
 - Integrated energy efficient systems



Typical Industrial Compressed Air System Components

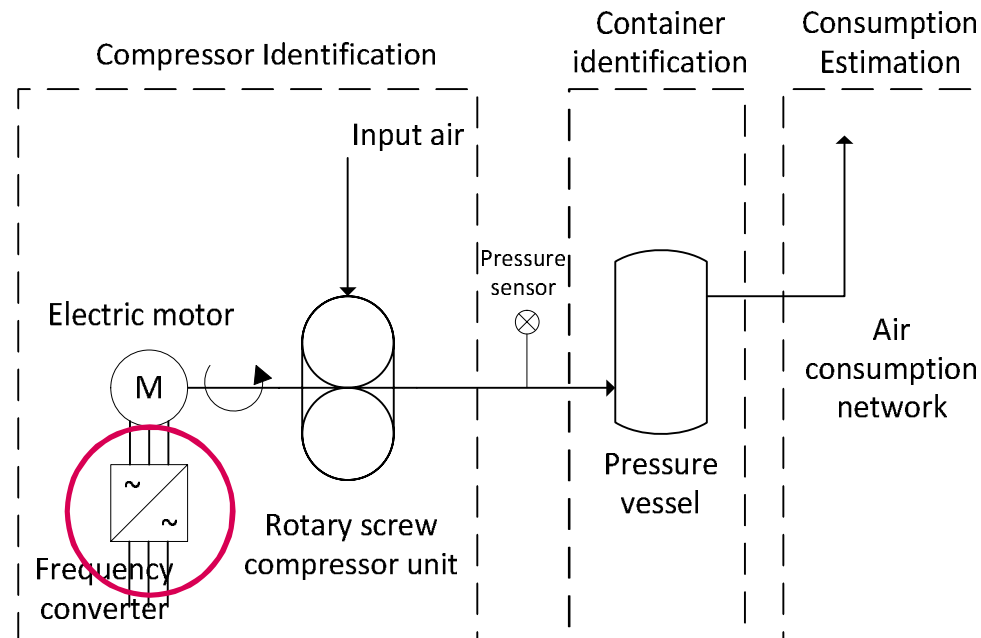




Compressed Air System Identification

Developing new methods that having a VSD can enable

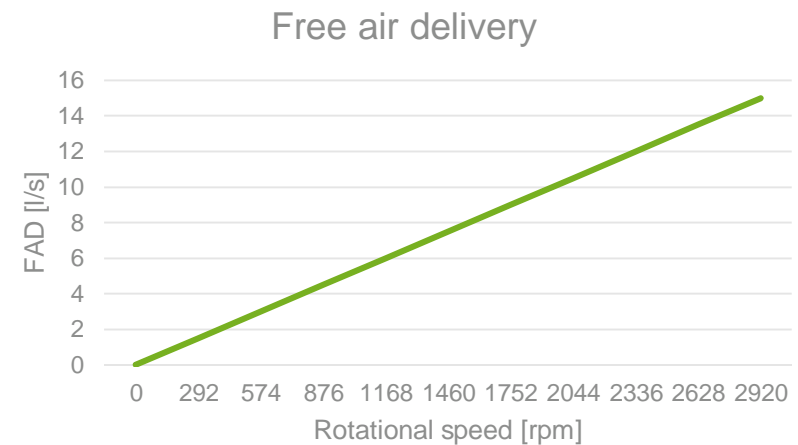
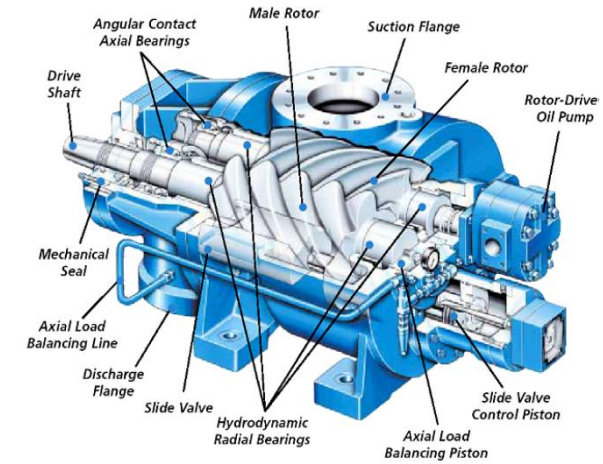
- Soft-sensoring system variables
- Condition monitoring





Twin screw compressor

- Screw structure allows for continuous compression
- Free air delivery is linear to drive shaft rotational speed





Compressed Air System Identification

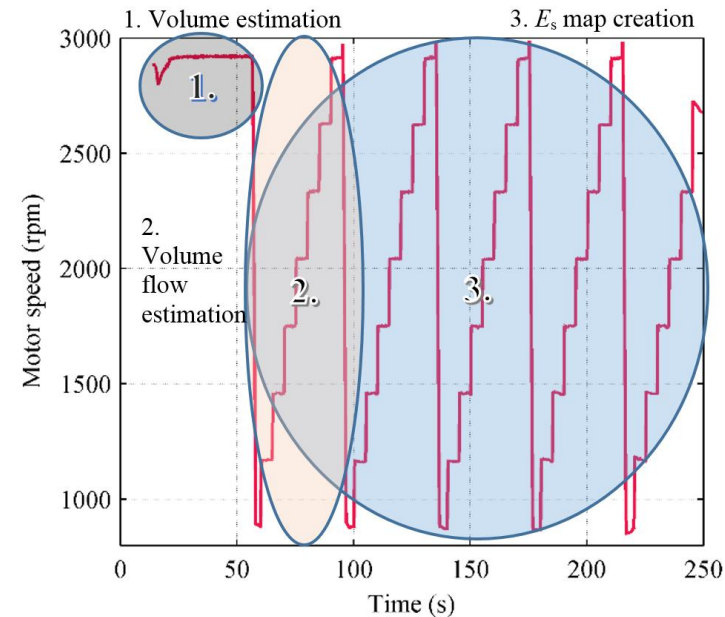
- Free air flow is known at nominal rotational speed

$$1. \quad V_{\text{sys}} = \frac{Q_{\text{vnet}} p_{\text{amb}}}{p_2 - p_1}$$

$$2. \quad Q_v = V_{\text{sys}} \frac{p_2 - p_1}{\Delta t p_s}$$

$$Q_m = \frac{p Q_v}{R_{\text{air}} T}$$

$$3. \quad E_s = \frac{P_{\text{compressor}}}{Q_m * 3600 \text{ s}}$$



Motor speed during an Identification run sequence

TABLE I
Results for volume flow of twin screw compressor



Volume flow estimation results

New method

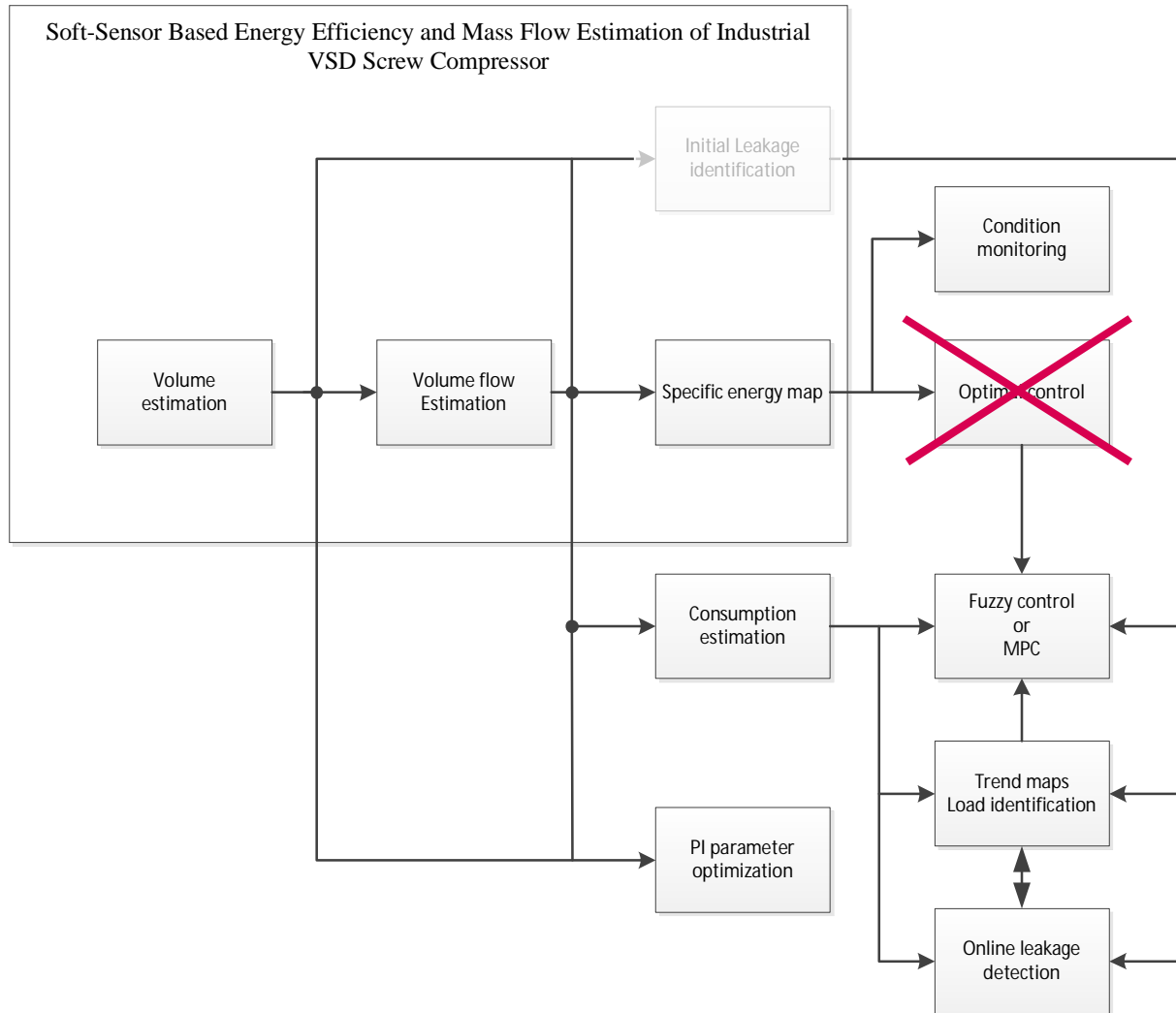
Laboratory tests show promising results considering volume flow estimation

TABLE I
RESULTS FOR VOLUME FLOW OF TWIN SCREW COMPRESSOR

Rotational speed (rpm)	F1 flow meter [l/s]	Volume flow estimate [l/s]	Datasheet [l/s]
2920	14.41	15.04	15
2628	13.02	13.48	13.5
2336	11.46	11.96	12
2044	10.02	10.31	10.5
1752	8.50	8.67	9
1460	6.97	6.89	7.5
1168	5.43	4.91	6
876	3.95	2.85	4.5



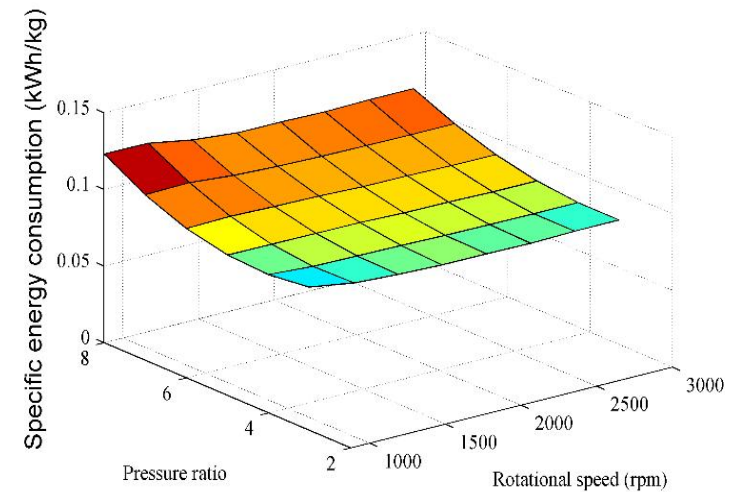
Research paths





Specific Energy Maps

- Could be used for condition monitoring
- Historical changes in Specific Energy Maps could show changes in the system





Future plans

- Development of laboratory equipment
- Reviewing of industrial pilot case
- Methods testing