CONTINUACION DEL VOLUME 2 – PART 2

SECTION 22.- IMPROVEMENTS IN TECHNOLOGY OR MODERNIZATION APPLICABLE TO RECIPROCATING COMPRESSORS.

CXLI.- TEMPORARY SUCTION SCREEN – RECIPROCATING COMPRESSORS

CXLII.- ADVANCED RECIPROCATING COMPRESSION TECHNOLOGY (ARCT)

SECTION 23.- LIQUIDS IN GAS SERVICE THROUGH RECIPROCATING COMPRESSORS

CXLVI.- WET GAS COMPRESSION IN RECIPROCATING COMP.

CXLVII.- EFRC GUIDELINES ON HOW TO AVOID LIQUID PROBLEMS IN RECIPROCATING COMPRESSOR SYSTEMS

SECTION 24.- RELIABILITY IN RECIPROCATING COMPRESSORS BY MANUFACTURERS

CXLVIII.- COOPER COMPRESSION INTRODUCES REVOLUTIONARY NEW RECIPROCATING COMPRESSOR

SECTION 25.- CONTROL AND REGULATION SYSTEMS APPLICABLE TO RECIPROCATING COMPRESSORS

CXLIX.- KEEPING MURPHY'S LAW IN CHECK (CONDITION ANALYSIS)

CL.- THE CHALLENGE OF INDUSTRY 4.0 APPLIED TO A STEPLESS CAPACITY REGULATION SYSTEM

CLI.- CAPACITY CONTROL BY MEANS OF HYDRAULIC OPERATED VARIABLE CLEARANCE POCKET

CLII.- COMPRESSOR CONTROLS IN RECIPROCATING COMPRESSORS

CLIII.- STEPLESS MASS FLOW CONTROL USING FIXED CLEARANCE POCKETS - A NEW SOLUTION USING AN OLD IDEA

CLIV.- STEPLESS CAPACITY CONTROL MAINTAINS EFFICIENCY OF FRENCH NATURAL GAS COMPRESSOR AS PRODUCTION DECLINES

2. OIL AND GAS IN AND AROUND VIC-BILH
3. THE VIC-BILH GATHERING STATION
4. THE NEED FOR CAPACITY CONTROL
5. STEPLESS CAPACITY CONTROL VIA SUCTION VALVE UNLOADING
6. PROJECT START AND CONTROL DECISIONS
7. INSTALLATION AND COMMISSIONING
8. CONCLUSIONS

CLV.- CONTROLLING RECIPROCATING AND CENTRIFUGAL COMPRESSORS IN IDENTICAL PROCESSES

1. INTRODUCTION
2. DISCUSSION
3. THE CONTROL OVERVIEW
4. METHOD OF CONTROL
5. RECIPROCATING COMPRESSOR CONTROL
    - 5.1.- Automatic Operation
    - 5.2.- Manual Operation
6. POTENTIAL PROBLEMS THAT WERE AVOIDED
7. CONCLUSION

CLVI.- COMPRESSOR CONTROL SYSTEMS

1 CONTROLS—DEFINITIONS
2 RECIPROCATING COMPRESSOR MONITORING
3 SYSTEM CONSIDERATIONS
4 SYSTEM SELECTION—DEFINE THE SCOPE
5 HUMAN FACTORS
6 ELECTRICAL AND ELECTRONIC CONTROLS
    - 6.1 Applicable Codes
    - 6.2 Electrical Controls
7 PNEUMATIC CONTROLS
8 MANUAL CONTROLS
9 PRELUBE-POST LUBE SYSTEM
10 LOADING-UNLOADING
11 CAPACITY CONTROL
12 LOADING AND UNLOADING
13 MONITORING COMPRESSOR PARAMETERS
14 SPECIAL COMPRESSOR CONTROLS
    - 14.1 Packing Case Purge Controls
    - 14.2 Compressor Rod Drop
    - 14.3 Vibration Monitoring
    - 14.4 Vibration Sensors
    - 14.5 Mounting Vibration Sensor
    - 14.6 Metal Particle Detectors
    - 14.7 Cautions
15 SPECIFICATIONS, CODES, AND STANDARDS

SECTION 26.- ROD LOADING AND PIN REVERSAL IN RECIPROCATING COMPRESSORS

CLVII.- UNDERSTANDING VARIOUS INDUSTRIAL INTERPRETATIONS OF ROD LOADING IN RECIPROCATING COMPRESSORS.

CLVIII.- COMPRESSOR PERFORMANCE AND OPTIMIZATION STAYING WITHIN ROD-LOAD AND PIN-REVERSAL LIMITS

CLVIX.- PERFORMANCE CONTROL OF RECIPROCATING COMPRESSORS: DEVICES FOR MANAGING LOAD AND FLOW

SECTION 27.- TYPES OF FAILURES IN RECIPROCATING COMPRESSORS

CLIX.- PRACTICAL ADVICE FOR ANALYZING, PREVENTING CYLINDER VALVE FAILURES

CLX.- CASE STUDY OF A BEARING FAILURE ANALYSIS

CLXI.- AUTOMATIC EARLY FAILURE DETECTION AND SHUTDOWN OF A CRITICAL COMPRESSOR DUE TO A CROSSHEAD FRACTURE

CLXII.- SCIENTIFIC RESEARCH METHODS TO ANALYSE COMPRESSOR WEAR PARTS AND LUBRICANTS

CLXIII.- HARD PARTICLE CONTAMINATION IN RECIPROCATING COMPRESSORS

CLXIV.- FAILURE ANALYSIS AND RECTIFICATION OF CONNECTING ROD BEARING FAILURE AGAINST MODIFIED COMPRESSOR OPERATION

CLXV.- USING "OEM" PERFORMANCE SOFTWARE TO ASSIST WITH TROUBLESHOOTING A CROSSHEAD FAILURE

CLXVI.- MACHINERY FAILURE ANALYSIS - *Sustain Your Operations and Maximize Uptime*

CLXVII.- MACHINERY FAILURE ANALYSIS - PROBLEMS

CLXXI.- REPLACING RECIPROCATING COMPRESSORS WITH CENTRIFUGAL MACHINES

SECTION 29.- INSPECTION & TESTING IN RECIPROCATING COMPRESSORS.

CLXXII.- RECIPROCATING COMPRESSOR TESTING

1.- MOTIVATION, JUSTIFICATION, AND OBJECTIVES

2.- MACHINERY SPECIFIC STANDARDS: RECIPROCATING COMPRESSORS

- 2.1.- Reciprocating Engines
- 2.2.- Performance Testing and Inspection

SECTION 30.- REVAMP, UPGRADE / RERATE IN RECIPROCATING COMPRESSORS

CLXXIII.- REVAMP OF AN EXISTING RECIPROCATING COMPRESSOR UNIT

1 INTRODUCTION

2 VERIFICATION OF COMPRESSOR FEASIBILITY

- 2.1 AS-BUILT SITUATION AND PRE-CHECK
- 2.2 PREPARATION OF AN ENGINEER BID
- 2.3 FEASIBILITY STUDY AND REVAMP POSSIBILITIES
  - 2.3.1 Evaluation Matrix
  - 2.3.2 Thermodynamics and compressor calculation
  - 2.3.3 Verification of compressor valves
  - 2.3.4 Mechanical properties, rod loads, bearing calculation
  - 2.3.5 Crankshaft Strength

3 VERIFICATION OF ACCESSORIES

- 3.1 MAIN MOTOR
- 3.2 TORSION ANALYSIS
- 3.3 GAS COOLERS, VESSELS, PIPING
- 3.4 PULSATION STUDY

4 MACHINE DIRECTIVE / ATEX

- 4.1 EVALUATION BY RISK ANALYSIS
- 4.2 RESULTS OF ANALYSIS

5 MANAGEMENT OF PRODUCT SAFETY

6 CONCLUSION

CLXXIIIA.- FREE FLOATING PISTON CASE HISTORY OF REVAMP OF EXISTING RECIPROCATING COMPRESSORS

CLXXIV.- TECHNICAL AND ECONOMICAL ASPECTS IN THE EVALUATION FOR UPGRADING A RECIPROCATING COMPRESSOR INSTALLATION

1. INTRODUCTION
2. THE OBJECTIVE
3. APPROACH
4. COMPRESSOR DESIGN
   - 4.1. FRAME & CROSSHEAD GUIDE ARRANGEMENT

CLXXV.- OPTIMIZATION & REVITALIZATION OF EXISTING RECIPROCATING COMPRESSION ASSETS

SECTION 31.- INSTALLATION, COMMISSIONING, STARTUP IN RECIPROCATING COMPRESSORS

CLXXVI.- COMMISSIONING AND STARTUP – AN ESSENTIAL ASSET MANAGEMENT ACTIVITY

CLXXVII.- RECOMMENDED PRACTICE FOR RECIPROCATING COMPRESSORS INSTALLATION AND INSTALLATION DESIGN

RECOMMENDED PRACTICE FOR MACHINERY INSTALLATION AND INSTALLATION DESIGN

CHAPTER 3—JOBSITE RECEIVING AND PROTECTION

CLXXVIII.- “HHE” AND “BDC” - COMPRESSOR RUN TEST

SECTION 32.- GUIDELINES AND INSTRUCTIONS FOR PACKING AND STORAGE IN RECIPROCATING COMPRESSORS

CLXXX.- PACKING PROCEDURE AND STORAGE INSTRUCTIONS (BY MANUFATURERS)

SECTION 33.- START-UP, OPERATION AND MAINTENANCE IN RECIPROCATING COMPRESSORS.

CLXXXI.- OPERATIONAL PROBLEMS AND MAINTENANCE OF COMPRESSOR VALVES.

- BASK FUNCTION OF A COMPRESSOR VALVE
1.- VALVE TYPES USED IN RECIPROCATING COMPRESSORS
    1.1.- RECTANGULAR ELEMENT VALVES
        1.1.1.- Feather Valves
        1.1.2.- Channel Valves
        1.1.3.- Reed Valves
        1.1.4.- Concentric Ring Valves
        1.1.5.- Ported Plate Valves
    1.2.- DISC VALVES
    1.3.- VALVE-IN-PISTON RECIPROCATING COMPRESSORS
2.- VALVE MATERIALS
    2.1.- SEALING ELEMENTS
    2.2.- PLASTIC COMPOSITES
    2.3.- SPRINGS
3.- VALVE FAILURE ANALYSIS
    3.1.- WEAR AND FATIGUE
    3.2.- FOREIGN MATERIALS
    3.3.- ABNORMAL MECHANICAL ACTION
4.- MAINTENANCE AND REPAIR OF COMPRESSOR VALVES
    4.1.- VALVE FAILURE GROUPINGS
    4.2.- ENVIRONMENTAL EFFECTS
    4.3.- ABNORMAL MECHANICAL ACTION
5.- TROUBLESHOOTING VALVE PROBLEMS
    5.1.- VALVE PROBLEMS
        5.1.1.- Testing
6.- COMPRESSOR PISTON ROD PACKING
    6.1.- PACKING TYPES
    6.2.- COOLED PACKING TYPE
    6.3.- PACKING RINGS
    6.4.- HOW COMPRESSOR PACKING WORKS
    6.5.- PACKING RING TYPES
    6.6.- PACKING RING SIDE CLEARANCE
    6.7.- MAJOR SOURCES OF PACKING PROBLEMS
        6.7.1.- Normal Wear
        6.7.2.- Causes of Abnormal Wear
        6.7.3.- Causes of Abnormal Wear of Teflon Packing Rings
        6.7.4.- Leakage
    6.8.- PACKING PROBLEMS
    6.9.- GARTER SPRING AND/OR RING BREAKAGE
    6.10.- RATE OF LEAKAGE
    6.11.- PISTON MOD OIL WIPER PACKING

CLXXXII.- STARTING, OPERATING AND MAINTENANCE PROCEDURES RELATED WITH RECIPROCATING COMP.

1.- SCOPE
2.- PREPARATION FOR START-UP
    2.1.- COMPRESSOR
3.- OPERATION
    3.1.- PREPARATION FOR INITIAL START-UP
    3.2.- INITIAL START-UP

CLXXXIII.- EXAMINING RECIPROCATING COMPRESSOR MAINTENANCE

CLXXXIV.- OPERATION AND MAINTENANCE OF RECIPROCATING COMPRESSORS IN THE NEW MILLENNIUM

SECTION 34.- MISCELLANEOUS TO IMPROVE RELIABILITY IN RECIPROCATING COMPRESSORS

CLXXXV.- FIRES AND EXPLOSIONS IN RECIPROCATING COMP.

1.- AFTERCOOLER AND COMPRESSOR FIRES

- **1.1.- WHAT WE KNOW**
- **1.2.- HOW FIRES START**

2.- CONSIDER SAFETY DEVICES

CLXXXVI.- COMPRESSOR PERFORMANCE CURVES

CLXXXVII.- CYLINDER DISPLACEMENT CURVES

CLXXXVIII.- ARRANGEMENTS IN RECIPROCATING COMPRESSORS AND PIPING RELATED WITH PROCESS PLANTS IN OIL/GAS & PETROCHEMICAL INDUSTRY

CLXXXIX.- PICTURES ABOUT ARRANGEMENTS AND MAIN COMPONENTS DESIGNED FOR PROCESS PLANTS - RECIPROCATING COMPRESSORS

CXC.- CLASSIFICATION OF HAZARDOUS ATMOSPHERES

CXCI.- GAS PROPERTIES AND BEHAVIOR

CXCII.- COMPRESSOR SPECIFICATIONS FROM THE 2022 COMPRESSOR SOURCING GUIDE SUPPLEMENTS (TECH2)

PART 2 – RECIPROCATING COMPRESSORS

SECTION 22.- IMPROVEMENTS IN TECHNOLOGY OR MODERNIZATION APPLICABLE TO RECIPROCATING COMPRESSORS.

CXLI.- TEMPORARY SUCTION SCREEN – RECIPROCATING COMPRESSORS

Installation of a temporary suction screen is recommended as an additional precaution to prevent dirt carryover, welding beads and other debris from entering the cylinders. A typical screen design is shown in Figure CXLI.1 with major details about, which are commercially available. A pressure gauge should be placed across the screen to measure the pressure drop. The screen should be removed and cleaned when the pressure drop has increased 10% of line pressure. Pressure drop across the screen must not exceed 20 PSIG (138 kPa)) on line pressures above 200 PSIG (1379 kPa). Pressure drop in excess of this value may collapse the screen.