HTM02-01 Design Consulting
Specialist in HTM02-01 Design.
+66(0)63 082 9692
kevin@htm02-01designconsult.com

Course Syllabus: HTM02-01 Medical Gas Pipeline Systems - Flow Calculations & Design Principles

Course Code: MGPS-01

Total Duration: 6 Hours

Format: Online (Instructor-Led or Self-Paced)

CPD Hours: 6

Level: Professional / Advanced

Target Audience: Healthcare Engineers, MEP Design Engineers, Medical Gas APs (Authorised Persons), Facility Managers, and Clinical Engineering Staff.

Course Description

This intensive, specialist course provides a comprehensive understanding of medical gas flow demand calculations for pipeline systems in accordance with HTM 02-01 Section 4. Participants will master the principles of diversified flow calculation for oxygen, medical air, nitrous oxide, vacuum, and other specialist gases. This course is the critical first step in the design process, teaching you how to determine the *minimum flow capacity* required for any section of the pipeline. Through practical examples and real-world scenarios, this course ensures engineers can specify correct flow demands, a fundamental requirement for ensuring systems are safe, efficient, and fully compliant with UK health technical memoranda.

Learning Outcomes

Upon successful completion of this course, participants will be able to:

- Apply the core design principles of HTM02-01 Section 4 (Clauses 4.5 & 4.6) to medical gas pipeline systems.
- Calculate accurate diversified flow rates for various medical gases across different clinical departments (wards, operating theatres, critical care, etc.).
- Understand the relationship between calculated flow demand and downstream pipe sizing.
- Differentiate between the design requirements for different medical gases (Oxygen, Medical Air 400kPa & 700kPa, Nitrous Oxide, Vacuum).
- Integrate multiple gas systems and apply appropriate safety factors for emergency and peak demand scenarios.
- Identify and mitigate common design errors and safety risks associated with medical gas systems.

Module Breakdown

Module 1: Introduction to HTM02-01 Section 4

- **Topics:** Purpose and scope of the standard; The critical impact of gas flow design on patient safety and clinical effectiveness; Overview of key design areas including terminal units, pipeline distribution, and gas-specific requirements.

- **Key Takeaway:** Understand the "why" behind the rigorous calculation standards.

Module 2: Fundamental Design Principles (Clauses 4.5 & 4.6)

- **Topics:** Pipe Sizing Philosophy (erring on the side of caution and how it relates to flow); Pressure Drop Criterion (maximum 5% loss and its importance for terminal unit performance); The critical principle of using *bed spaces*, not terminal units, for diversified flow calculations.
- **Key Takeaway:** Learn the non-negotiable "golden rules" that govern all MGPS design and how flow calculations feed into the wider system design.

Module 3: Oxygen Systems Design & Diversification

- **Topics:** Flow requirements for in-patient wards, operating departments (including oxygen flush), critical care/HDU, and LDRP rooms; Applying diversity factors; Calculating total demand for multi-ward departments; Safety considerations for CPAP and ventilators.
- **Practical Exercise:** Calculate the diversified oxygen flow for a sample ward and operating theatre suite.

Module 4: Nitrous Oxide & Analgesic Gas Mixtures

- **Topics:** Nitrous oxide flow requirements and diversification; Entonox (Nitrous Oxide/Oxygen Mixture) peak "gasp" flow (275 L/min) and continuous flow demands; Specialised calculations for maternity units (LDRP rooms).
- **Key Takeaway:** Design for short-duration, high-flow peaks alongside continuous analgesic use.

Module 5: Medical Air & Surgical Air Systems

- **Topics:** Differentiating between Medical Air (400 kPa) for ventilators and Surgical Air (700 kPa) for tools; Flow requirements for ventilators, nebulisers, and surgical equipment; Dual-pressure regulation system design; Diversification strategies for operating theatres.
- **Key Takeaway:** Ensure critical ventilator supply and high-pressure tool performance through correct system design.

Module 6: Vacuum & Specialist Systems

- **Topics:** Vacuum system design principles and peak flow requirements (e.g., for orthopaedic surgery); An introduction to Helium/Oxygen mixtures (Heliox) and Anaesthetic Gas Scavenging Systems (AGSS) flow calculations.
- **Key Takeaway:** Size vacuum systems for intermittent but high-volume peak demands.

Module 7: System Integration & Practical Calculation Workshop

- **Topics:** Integrating multiple gas systems for a full facility; Applying diversity across multiple wards; Pressure regulation and emergency provisions.
- **Practical Workshop:** A guided, step-by-step calculation of total oxygen, medical air, and vacuum demand for a mixed facility comprising operating theatres, a recovery area, and patient beds.

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Module 8: Safety, Compliance & Best Practices

- **Topics:** Critical safety considerations for each gas type (e.g., fire risk with oxygen, ventilator failure with medical air); Common design errors to avoid; Implementing alarm and monitoring systems; Overview of testing and verification.
- **Key Takeaway:** Embed safety and reliability at the core of all MGPS designs.

Assessment of Learning

- **Final Knowledge Check:** A 15-question multiple-choice quiz assessing understanding of key principles, standards, and calculation logic.
- **Successful Completion:** A minimum score of 80% is required to pass and receive a certificate.

Course Materials & Resources

- **Digital Workbook:** Includes all key formulas, diversification tables (from HTM02-01), and quick-reference guides.
- **Slide Deck:** Comprehensive presentation covering all modules.
- **Practical Calculation Worksheets:** For use during the workshop and future reference.

Prerequisites

A basic understanding of mechanical engineering principles or prior experience in healthcare engineering is recommended. No prior specific knowledge of HTM02-01 is required.

Certification

Upon successful completion, participants will receive a **Certificate of Completion** listing their name, the course title, the CPD hours earned (6), and the date of completion.