PAS 2035: A New Standard for Domestic Retrofit

Dr Peter Rickaby
Each Home Counts Implementation Board
Chair, BSI Retrofit Standards Task Group
It’s not just Grenfell Tower...

- Glasgow
  - Four tonnes of EWI fell off the top of a residential tower
- Edinburgh
  - All the EWI fell off a gable wall of Oxgangs School
- Preston
  - Over 300 homes made uninhabitable by EWI
- Grenfell Tower
  - 71 dead after fire spread via insulated external cladding
- Numerous other CWI and EWI failures
  - Mostly inappropriate or incompetent installations
Retrofit Process?
(Green Deal and ECO)

Assessment → Design? → Installation → Operation
Managing Retrofit Risk

Technical Risks
• Putting the correct package of improvements in place
• Managing the interactions between measures
• Managing moisture, IAQ and ventilation
• Avoiding unintended consequences

Process risks
• Assigning tasks to the correct people
• Ensuring appropriate qualifications, skills and tools
• Auditing and inspecting (based on risk assessment)
• Monitoring and evaluation of completed projects
• Feed-back for process improvement
RE:NEW Risk Management Process

PROCESS

START

TRIAGE MATRIX

DETAILED ASSESSMENT

IN-HOUSE EXPERTISE?

high risk

low risk

TOOLS

WATCH POINTS

FACT SHEETS

STBA GUIDANCE WHEEL

RISK WORKSHOPS

RETROFIT COORDINATOR

SUPPORT OPTIONS

DETAIL AUDITS

MONITORING AND EVALUATION

yes

no
## RE:NEW Technical Risk Matrix

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**Legend:**
- **IWI** - Insulation and Wall Insulation
- **EWI** - External Wall Insulation
- **Cavity Wall**
- **Loft Insulation**
- **Roof Insulation**
- **Underfloor Insulation**
- **Window & Door Upgrades**
- **Chimney balloons/baffles**
- **Draft-proofing**
- **MVHR**
- **Boiler replacement**
- **Cylinder insulation & Plumbing lagging**
- **Solar Thermal**
- **Heating controls**
- **Heat Pumps (ASHP/GSHP)**
- **Communal/District Heating**
- **Solar PV**
Each Home Counts

Dr Peter Bonfield, OBE, FREng

Department for Business, Energy & Industrial Strategy
Department for Communities and Local Government

December 2016
Each Home Counts: Vision

Standards
- Retrofit Consumer Charter
- Retrofit Code of Conduct (Behaviour)
- Retrofit Code of Practice (Technical standards)
- Quality Mark Mandatory for publicly funded retrofit

Advice, skills, training
- Information and Advice Hub
- Guidance
- Training

Retrofit Process
- Assessment Whole-dwelling
- Design Including medium-term whole-dwelling retrofit plan
- Installation
- Commissioning
- Handover

Quality Assurance
- Data Warehouse Records of all retrofit
- Quality Mark - Enforcement
- Monitoring and Evaluation

Feedback
Each Home Counts: Progress
Each Home Counts

Standards
- Retrofit Consumer Charter
- Retrofit Code of Conduct (Behaviour)
- Retrofit Code of Practice (Technical standards)
- Quality Mark (Mandatory for publicly funded retrofit)

Advice, skills, training
- Information and Advice Hub
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Retrofit Process
- Assessment Whole-dwelling
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Quality Assurance
- Data Warehouse (Records of all retrofit)
- Quality Mark Enforcement
- Monitoring and Evaluation

Feedback
BSI Retrofit Standards Framework

Objectives

• Improve functionality and durability of buildings
• Improve the comfort and well-being of occupants
• Improve energy efficiency
• Reduce environmental impact
• Protect and enhance architectural heritage
• Minimise the ‘performance gap’
• Avoid unintended consequences

Principles

• Focus on materials, workmanship and processes
• Make retrofit standards accessible (online portal)
• Combine technical standards with guidance
The BSI Retrofit Standards Framework

Each Home Counts

- Code of Conduct
- Quality Mark
- Customer Charter

Each Home Counts

‘Code of Practice’
PAS 2035 Specification and Guidance for the Energy Retrofit of Dwellings

- Existing BSI Standards
  - Including PAS 2030, BS 5250, BS 7913, etc.
- New BSI standards
  - Assessment, Air-Tightness + Ventilation, Energy Advice, Monitoring & Evaluation
- Non-BSI Standards
  - Existing standards, e.g. NIA/INCA/SWIGA, MCS, CIBSE
Features
1. Project manager responsible for compliance
2. Risk assessed paths deal with complexity
3. Externally managed qualifications register

UK RETROFIT QUALIFICATIONS REGISTER
(Externally managed)
Proposed structure (PAS 2035 Draft 2)

**PAS 2035**
- PROJECT MANAGEMENT
  - DWELLING ASSESSMENT
  - VENTILATION ASSESSMENT
  - RISK ASSESSMENT
- UK RETROFIT QUALIFICATIONS REGISTER (Externally managed)
- MONITORING AND EVAL (Path 1)
  - Annex A Measures interaction
  - Annex B Ventilation
  - Annex C Advice
- INSTALLATION
  - Measure specific annexes
- COMMISSIONING AND HANOVER

**PAS 2030**
- Design Path 1
- Design Path 2
- Design Path 3
- Path 2 MONITORING AND EVAL
- Path 2 MONITORING AND EVAL
- Path 3 MONITORING AND EVAL
PAS 2035 Risk Assessment

- Carried out by Retrofit Project Manager
  - After whole-dwelling and ventilation assessments
- Risk assessed as Low | Medium | High
  - Depending on five criteria
- Assessed risk determines Path through the PAS
  - Path 1: Low risk = PAS 2030 requirements
  - Path 2: Medium risk = more onerous requirements
  - Path 3: High Risk = much more onerous requirements
- Retrofit Project Manager
  - Path 1: qualified construction project manager
  - Paths 2 and 3: qualified Retrofit Coordinator
### PAS 2035 Risk Assessment Criteria

#### Average number of measures per dwelling

<table>
<thead>
<tr>
<th>Average number of measures per dwelling</th>
<th>Risk grade</th>
<th>Assessed grade</th>
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<tr>
<td>1</td>
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<td>2-4</td>
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#### Inherent technical risk of highest risk measure

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<th>Risk Grade</th>
<th>Assessed grade</th>
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#### Highest risk combination of measures

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<th>Risk Grade</th>
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<tr>
<td>GREEN</td>
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<td>ORANGE</td>
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<td>YELLOW</td>
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#### Age of oldest building

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<td>pre 1919</td>
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<td>1919-1939</td>
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<td>1946-1959</td>
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<td>1960-1976</td>
<td>MEDIUM</td>
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<td>post 1976</td>
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#### Construction and built form of buildings

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<th>Construction and built form of buildings</th>
<th>Risk Grade</th>
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<td>Traditional (heritage pre-1919)</td>
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<td>System-built (high-rise &gt; 18m)</td>
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<tr>
<td>System built (medium-rise 1960-1976)</td>
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<td>Traditional (low-rise post 1918)</td>
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#### Aggregation

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<th>Highest assessed grade</th>
<th>PAS 2035 Path</th>
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PAS 2035 Measures Interaction Matrix
PAS 2035 Ventilation

‘No insulation without ventilation!’

Assessment

- Existing ventilation is **inadequate** if
  - Evidence of condensation or mould
  - No working ventilation system present
  - IEV or PSV present but incomplete (including air inlets)
  - Good IEV or PSV but intended/potential $Q_{50} < 5 \text{ m}^3/\text{m}^2\text{h}$

Upgrade

- If existing ventilation is inadequate then
  - If intended $Q_{50} > 5 \text{ m}^3/\text{m}^2\text{h}$ then install IEV or PSV
  - If intended $Q_{50} < 5 \text{ m}^3/\text{m}^2\text{h}$ then install MEV or MVHR
  - System capacity must be based on full occupancy
PAS 2035 Summary

• Risk assessment
  • After whole-dwelling and ventilation assessments
  • Determines the Path (1-3) through the PAS

• Retrofit Designer and Retrofit Project Manager
  • Qualification depends on project risk assessment
  • High risk projects must have Retrofit Coordinator

• Measures Interaction Matrix
  • Used in risk assessment (inherent and combined risks)
  • Identifies where retrofit design must consider interfaces

• Ventilation
  • Assessment of existing
  • Upgrade to IEV or PSV if inadequate and intended $Q_{50} > 5$
  • Upgrade to MEV or MVHR if intended $Q_{50} < 5$
PAS 2035: A New Standard for Domestic Retrofit

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