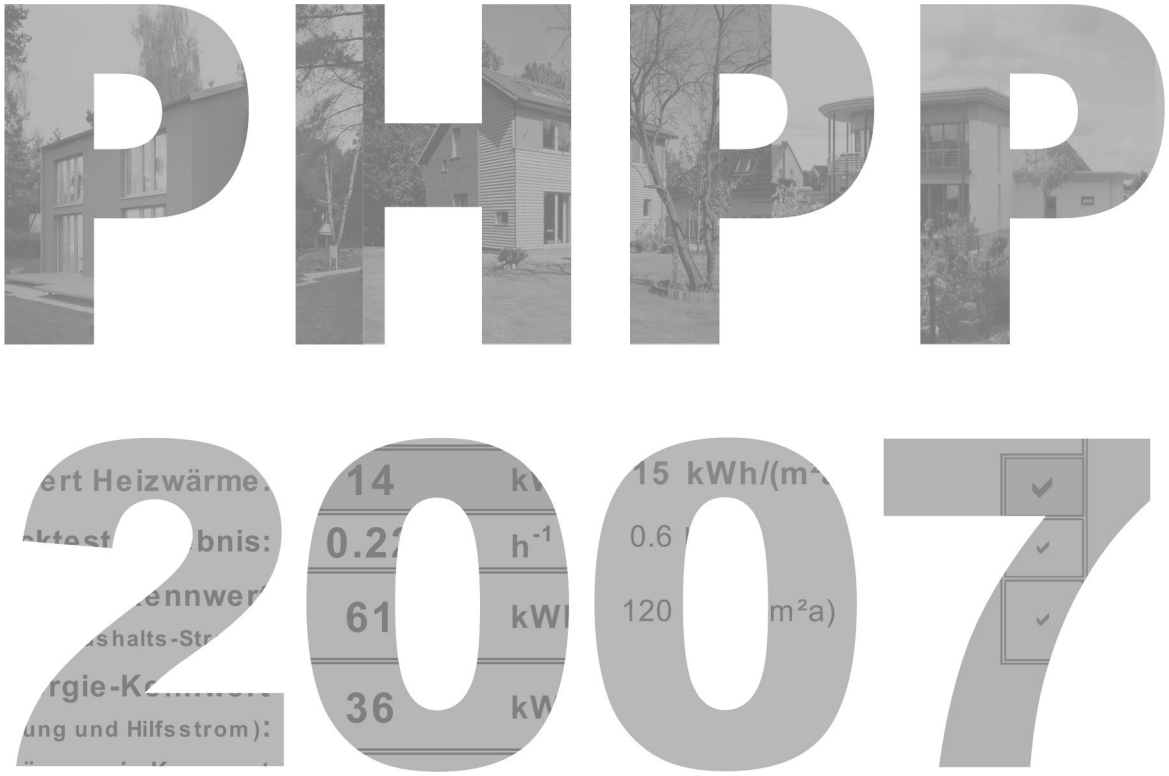
PASSIVE
HOUSE
INSTITUTE
Dr. Wolfgang Feist

Technical Information PHI-2007/1(E)

Passive House Planning Package 2007



Specifications for

Quality Approved Passive Houses

Passive House Planning Package 2007

Specifications for Quality Approved Passive Houses

Authors:
Dr. Wolfgang Feist
Dr. Rainer Pfluger
Dr. Berthold Kaufmann
Dipl.-Phys. Jürgen Schnieders
Dipl.-Phys. Oliver Kah
Darmstadt, June 2007

English translation by
Dipl.-Ing. Zeno Bastian and
Andrew Peel

System requirements:

Microsoft® Windows 95 or higher
Microsoft® EXCEL® 2000 or higher

According to the authors, PHPP can also be used under OpenOffice (Version 2.2 or higher) and on Macintosh computers. However, no systematic tests on this have been carried out. So there is no warranty given, that this will work under all circumstances.

The authors reserve the right to adapt the content of worksheets to the progress of science and technology.

Microsoft®, Windows® and EXCEL® are registered trademarks of Microsoft Corporation

The Passive House Institute

was founded by Dr. Wolfgang Feist in 1996. The Institute specializes in research and development in the field of highly efficient energy use. The Passive House Energy Standard increases energy efficiency in residential buildings by a factor of 10.

The Passive House Institute offers the following services:

- Accompanying Physics Research: On Site Measurements, Analysis
- Dynamic Building Simulations for Existing and New Buildings
- Computational Fluid Dynamics (CFD)
- Two- and Three-Dimensional Heat Flow Calculations, Dynamic Heat Flow Simulations
- Ventilation System Measurements (Air Flow Rates, Temperature, Humidity, etc.)
- Quality Assurance, Passive House Certification
- Field Measurements, Short and Long Term
- Indicator Gas Measurements with Non-Toxic Tracer Gas
- Consulting on Product Development
- Certification of Building Products for Passive Houses
- Daylighting Simulation
- Blower-Door Test
- Infrared Thermography
- Software Development
- Seminars and Conferences
- Expert's Reports

Table of Contents

Foreword to the Revised Edition 2007 7

Foreword to the First English Edition 2004 7

Foreword to the First German Edition 1998 8

New in the Passive House Planning Package 2007 9

1 First Steps 12

2 Introduction 14

2.1 Projecting of Passive Houses 14
2.2 Residential Use 15
2.3 Other Uses (Non-residential Buildings) 16
2.4 Installation Recommendations 17
2.5 Excel and the PHPP 17

3 Certification of Passive Houses 22

3.1 Evaluation Criteria for the Certification 23
3.2 Documentation Required for the Passive House Quality Approval Certificate 24
3.3 Procedure of the Quality Approval 27
3.4 Calculation Methods, Basic Conditions, Reference to Norms 28

4 Sequence of Entries 30

5 "Brief Instructions" Worksheet 32

6 "Verification" Worksheet: Building Data Documentation and Passive House Standard Verification 33

6.1 User Dependent Data and Standard Use 33
6.1.1 Interior Temperatures 33
6.2 Selection of the Calculation Method 34
6.3 Climate Region 35
6.4 Calculation Results 35

7 "Areas" Worksheet 37

7.1 Reference to Exterior Dimensions 37
7.2 List of Areas 38
7.3 Entering Areas for Walls, Roofs, Ground 42
7.4 U-Values 43
7.5 Radiation Balance of Roofs and Exterior Walls 43
7.6 Window Areas and Exterior Doors 44
7.7 Transfer of the Results 45
7.8 Calculating the Treated Floor Area 45

7.9 List of Thermal Bridges 46

8 "U-List" Worksheet 49

9 "U-Values" Worksheet: Calculation of Building Element U-Values 50

9.1 Still air spaces 53

9.2 Wedge-Shaped Building Assemblies in Compliance with ISO 6946 54

9.3 Composite Building Elements 55

10 "Ground" Worksheet: Calculating the Heat Losses from Below-Ground Building Elements 56

10.1 Required Building Information 58

10.2 Heated Basement or Buried Floor Slab 58

10.3 Unheated Basement 58

10.4 Slab On Grade 59

10.5 Raised Floor Slabs 60

10.6 Thermal Bridges 60

10.7 Ground Water 61

10.8 Results 62

11 "Windows" Worksheet: Window Area Calculations, Window U-Values and Orientation Dependent Solar Radiation 64

11.1 Solar Radiation and Window Direction 64

11.2 Local Solar Radiation Data 66

11.3 Window Data Entries 66

11.4 Window Installation 67

11.5 Reduction Factors for Solar Gains 73

12 "WinType" Worksheet 74

13 "Shading" Worksheet 76

13.1 Shading by a row of houses 76

13.2 Shading by Window Reveals 78

13.3 Shading by Cantilevered Elements, e.g. Balcony Slab or Lintel 78

13.4 Additional Shading Elements 79

14 "Ventilation" Worksheet: Sizing the Ventilation System 81

14.1 General Planning Instructions 81

14.2 Air Change 82

14.3 Infiltration 85

14.4 Heat recovery 87

14.5 Subsoil Heat Exchanger 89

15 "Annual Heat Demand" Worksheet: Calculating the Annual Heat Demand According to the PHPP method 91

15.1 Heat Demand Balance 91

15.2 Heat losses 92
15.2.3 Total Heat Losses 98
15.3 Heat Gains 99
15.4 Free Heat Gains 101
15.5 Free Heat Utilisation Factor 101
15.6 Useful Heat Gains 101
15.7 Heat Demand 101
15.8 Requirement 101

16 "Monthly Method" Worksheet: Calculating the Annual Heat Demand According to EN 13790 / Monthly Method 103

17 "Heating Load" Worksheet: Determining the Space Heating Load 105

17.1 Climate Data for Heating Load Calculations 106
17.2 Building Data 106
17.3 Walls and Ceilings between Adjacent Residential Units 106
17.4 Internal Heat Loads 107
17.5 Heat Losses 107
17.6 Heat Gains 108
17.7 Maximum Heating Load 108
17.8 Maximum Heating Load Transportable through the Ventilation System 108
17.9 Evaluation of Group Heating Capacity for Individual Rooms 112

18 "Summer" Worksheet: Calculating the Frequency of Temperatures above the Summer Comfort Limit 113

19 "Shading-S" Worksheet 117

20 "SummVent" Worksheet: Air Exchange Using Natural Ventilation 120

21 "Cooling" Worksheet: Calculation of the Sensible Useful Cooling Load 123

22 "Cooling Units" Worksheet: Calculation of the Energy Demand for Space Cooling and Dehumidification 125

22.1 Supply Air Cooling 125
22.2 Recirculation Cooling 126
22.3 Surface Cooling 126
22.4 Extra Dehumidification 127

23 "Cooling Load" Worksheet: Average Daily Cooling Load 129

24 "DHW+Distribution" Worksheet: Calculating the Heat Losses through Plumbing 131

24.1 Heat Distribution 131
24.2 Heat Demand for Domestic Hot Water 132
24.3 Domestic Hot Water Distribution and Storage 132

25 "Solar DHW" Worksheet: Calculating the Total Heat Contribution from the Solar Thermal System to the DHW Supply 136

26 "Electricity" Worksheet: Calculating the Electricity Demand 139

26.1 Setting Goals and Requirements 139

26.2 Domestic Electricity Demand Calculation Procedure 140

26.3 Explanations for Energy Services 144

26.3.1 Dishwashers 144

27 "Electricity Non-Dom" Worksheet: Calculation of Electricity Demand for Non-Residential Buildings 152

27.1 Methods for Calculating the Electricity Demand of Non-Residential Buildings 152

28 "Aux Electricity" Worksheet: Calculating the Auxiliary Electricity Demand 156

28.1 Ventilation System 157

28.2 Heating System 158

28.3 DHW System 159

28.4 Other Auxiliary Electricity 161

29 "PE Value" Worksheet: Calculating the Primary Energy Demand and CO_2 Emissions 162

29.1 Solar Thermal Collector Systems 164

29.2 Final Energy Demand 164

29.3 Primary Energy Demand 165

29.4 Requirement 167

29.5 Carbon Dioxide Emissions 167

30 "Compact" Worksheet: Calculation of Passive House Compact Units 169

30.1 Fundamentals and Calculation Principles 169

30.2 Data Input and Calculation 170

31 "Boiler" Worksheet: Calculating the Performance Ratio of Boilers 175

32 "District Heating" Worksheet: Calculating the Performance Ratio of District Heat Transfer Stations 177

33 "Climate Data" Worksheet 179

33.1 Standard Climate 179

33.2 Regional Data 180

33.3 User Data 181

33.4 Climate Data for Heating and Cooling Load 183

33.5 PHPP in the Southern Hemisphere 183

34 "IHG" Worksheet: Calculation of Internal Heat Gains 184

35 "IHG Non-Dom" Worksheet: Calculation of Internal Heat Gains in Non-Residential Buildings 187

36 "Use Non-Dom" Worksheet: Non-residential Buildings User Profiles for the Calculation in Electricity Non-Dom and IHG Non-Dom 189

37 Symbols and Definitions 192

38 References 195

39 Index 200