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GUIDE AND FORMAT FOR THE
PREPARATION OF A HOUSING SYSTEM
TESTING AND ANALYSIS PROGRAM
FOR
OPERATION BREAKTHROUGH
HOUSING SYSTEMS

A PRELIMINARY REPORT
VOLUME II - MULTIFAMILY LOW RISE

NBS REPORT 10213

4 VOLUMES

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Guide and Format for the
Preparation of a Housing System
Testing and Analysis Program

for:

OPERATION BREAKTHROUGH

HOUSING SYSTEMS

A Preliminary Report
Volume II - Multifamily Low Rise

by The Building Research Division Team
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Washington, D.C. 20410

U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS REPORT

Guide and Format for the Preparation of a
Housing System Testing and Analysis Program

1. Introduction

The purpose of this document is to guide and assist the Housing System Producer (HSP) in his preparation of the required testing and analysis program. This program should indicate the procedures that will be used to demonstrate that the performance levels as stated in the HUD Guide Criteria* developed for Operation BREAKTHROUGH will be satisfactorily met.

The information is to be submitted in three formats:

- A. TESTING AND ANALYSIS PLAN (See Section 4, Format for Testing and Analysis Plan, on page 3.)
- B. SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM (See Section 5, Summary of Testing and Analysis Program, on page 4.)
- C. SCHEDULE OF PHYSICAL TESTING (See Section 6, Schedule of Physical Testing, on page 6.)

The acceptability of each HSP's testing and analysis program will be determined by HUD from the above data and the program shall be revised by the HSP if required.

2. Scope of Testing and Analysis Program

A program for each proposed housing type requiring independent consideration (Multifamily High Rise, Multifamily Low Rise, Single Family Attached, or Single Family Detached) should be submitted. To expedite approval,

*(Guide Criteria for Design and Evaluation of: Operation BREAKTHROUGH Housing Systems, Volumes I through IV.)

the testing and analysis program shall contain adequately documented and detailed information. It will not be sufficient to merely state that a physical test will be conducted. The testing and analysis program shall include specific information on the tests to be conducted, the test methods to be used, the components or modules to be selected for testing, etc. When documented evidence of previous testing is proposed for use in the HUD evaluation, information giving the source of the document, an outline of the testing and analysis procedure used, and the identity of the testing authority must be included.

Testing and analysis is not intended for the purpose of developing and/or improving the design of system components.

3. General Guidelines for the Testing and Analysis Program

Compliance with any criterion should be demonstrated by one or more of the following:

- A. Review of plans and specifications.
- B. Review of previous documented testing.
- C. Accepted certification or standards.
- D. Professional judgment based upon previously documented user-experience.
- E. Analysis by rational application of engineering and scientific principles including calculations as required.
- F. Physical examination or testing of materials, components, modules, living units or complete buildings.
- G. On-site evaluative measurement in or of complete buildings.

Most of the criteria can be satisfied through professional judgment based upon documented prior experience, examination of plans and specifications, and/or computational analysis. Physical testing should be proposed when sufficient information cannot be adequately obtained by other means; or when testing is a more acceptable means (time, cost, etc.) for demonstrating compliance with criteria.

Since environmental exposure will vary with geographic locale, design information on load levels such as snow, wind and thermal or earthquake severity, etc., should be given in detail. If the housing system is to be applicable for a wide range of conditions or is to be limited to specific geographic regions, statements to that effect should be made and evidence provided to clearly indicate that extreme load conditions either have or have not been taken into account.

4. Format for Testing and Analysis Plan

As part of the overall testing and analysis program, an individual testing and analysis plan shall be prepared by the HSP for each criterion which explains in detail how he plans to demonstrate that the intent of each criterion has been or will be satisfied (see Figure 1, SAMPLE TESTING AND ANALYSIS PLAN). As mentioned in Section 2, on page 1, and Section 3, on page 2, the information shall include the following when applicable:

- A. Identification or related drawings, plans and specifications.
- B. Type, number, style, size of specimen(s), etc.
- C. Test methods to be used including special conditions, testing organizations, etc.
- D. Evidence of conformance with recognized standards.
- E. Documentation attesting to previous applicable certification and/or testing.
- F. Calculation methods used and actual calculations.

G. Documentation attesting to pertinent experience data.

II. Other information relative to the particular criterion.

The testing and analysis plans shall be prepared on 8 1/2" x 11" or 8 1/2" x 14" sheets (leaving a margin of at least 1" on the left side) which shall be grouped by HUD Guide Criteria Matrix intercept (A.1, A.2, L.9. See Figure 2). Each intercept grouping should be annotated with the name of the HSP, the building type, and the number of abbreviated title of the criterion to which it relates as listed in the attached SUMMARY FORMS. The criterion numbers are those in the HUD Guide Criteria which should be consulted for details of each criterion.

5. Summary of Testing and Analysis Program

The summary listing of the proposed testing and analysis program to be prepared by the HSP will provide an overview of the various tasks and will permit scheduling of activities. Listing of criteria are provided on the attached SUMMARY FORMS which give criterion numbers and abbreviated performance statements. Figure 3 is a sample showing how this form can be completed. Information on this SUMMARY FORM is divided into two categories.

Category I, Evaluation of Plans and Specification and Documentation, includes those evaluations which are proposed to be made by either:

- A. Review of plans and specifications,
- B. Analysis by rational application of engineering and scientific principles, or
- C. Analysis of previous test results or approved Industry Certification.

Category II, Evaluation of Physical Elements, should include those evaluations which are proposed to be made by:

- A. Professional judgment based on examination of components and/or assemblies, or

B. Physical testing and analysis of results.

Under the first column of Category I, Review of Plans and Specifications, a check mark will be sufficient. For the other columns of Category I and Category II the identity of the specimen(s) is needed. The specimen(s) should be identified by one of the following symbols:

<u>Ma</u> - for materials,	<u>H</u> - housing unit, and
<u>C</u> - component	<u>Hs</u> - housing system.
<u>M</u> - module	

Material is any single element such as surface coating for floor, wall, etc. Component is an assembly of elements such as: a mechanical system, composite wall panel, window assembly, etc. Module is a volumetric assembly having walls, ceiling and floor. Housing unit is an assembly of modules and/or components making up at least one complete living unit. Housing system is a complete structure erected on site.

Where the treatment of some criteria has been completed, the specimen(s) symbol should be circled.

There may be some criteria which will not be applicable for certain types of construction. In these cases mark "NA" as appropriate under Categories I and II.

6. Schedule of Physical Testing

If physical testing is proposed, a schedule shall be prepared and submitted to assure the adequate planning of this phase. This schedule shall follow the format outlined in Figure 4.

The test schedule shall include only tests or groups of tests which require a specimen to be specially procured or fabricated for the purpose of performing physical tests.

The test schedule prepared should be hardware oriented, by specimen. The schedule shall show by a dashed line the manufacturing or procurement lead-time for each specimen and the shipment of specimens to the test

facility. The total testing time required shall be shown by a solid line (including erection, instrumentation and test time) and the analysis time required after each test shall be shown by a dotted line. A particular specimen (module, component, etc.) may be used concurrently or in sequence to demonstrate adequacy with respect to more than one criterion. Scheduling should be by calendar week estimating start and completion dates. The overall schedule will be used to assure that the procurement of sufficient number of test specimens are contemplated for the performance of the required tests in the overall time frame of the program.

7. Recommended Testing Laboratories

For each test which must be conducted as shown on the SCHEDULE FOR PHYSICAL TESTING, Figure 4, the proposed testing laboratory along with alternate testing organizations should be identified. If consultants are used, the consultant, or consulting firm, along with alternates should be also identified.

In considering possible testing facilities, it should be noted that Federal laboratories with applicable capabilities are available and may be utilized in this program. Agreements have been reached, or are contemplated, making available the facilities of the National Bureau of Standards, Gaithersburg, Maryland, the Forest Products' Laboratory, Madison, Wisconsin, the Naval Civil Engineering laboratory, Port Hueneme, California, and the Army Construction Engineering Research Laboratory, Champaign, Illinois.

8. List of Required Submittals

As described in this document, three separate submittals comprising the proposed testing and analysis program are to be prepared:

- A. TESTING AND ANALYSIS PLANS; on 8 1/2" x 11" or 8 1/2" x 14" sheets, grouped by matrix intercept.
- B. SUMMARY FORMS FOR TESTING AND ANALYSIS PROGRAM (one set for each building type).
- C. SCHEDULE OF PHYSICAL TESTING.

TESTING AND ANALYSIS PLAN

Housing System Producer XYZ Corporation

Building Type Multifamily High Rise

E.7.3.1 Air Infiltration through exterior Wall System

1. Propose to use window assembly (No. 24A), door assembly (No. 31C) and preformed panel wall system (Model No. 313).
2. Scale drawings and detailed specifications of test specimens will be furnished.
3. Test has been conducted at the "Universal Testing Laboratory", Tucson, Arizona. NAAIM Interim Standard TM-1-68T (4.3 Test for Air Infiltration) used. Door assembly not included in test. Test Report #24381, Universal Testing Laboratory, to be furnished.
4. Door assembly will be described by detailed drawings and will be tested at "ABC Testing Laboratories", Denver, Colorado, or other testing laboratory meeting your approval, using ASTM E-283 Test Method; or a door assembly having a previously certified performance level and satisfying the criteria will be used and appropriate documentation furnished.

Figure 1.

Built Elements			Attributes								
			1	2	3	4	5	6	7	8	9
STRUCTURE	A										
	WALLS AND DOORS, INTER-DWELLING	B									
	WALLS AND DOORS, INTRA-DWELLING	C									
	FLOOR-CEILING	D									
EXTERIOR ENVELOPE	WALLS, DOORS AND WINDOWS	E									
	ROOF-CEILING, GROUND FLOOR	F									
	FIXTURES AND HARDWARE	G									
	PLUMBING	H									
	MECHANICAL EQUIPMENT, APPLIANCES	I									
	POWER, ELECTRICAL DISTRIBUTION, COMMUNICATIONS	J									
	LIGHTING ELEMENTS	K									
	ENCLOSED SPACES	L									7

Figure 2

Housing System Producer: <u>XYZ Corporation</u>		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM
Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u>		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: _____		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend
Criteria							Ma -Material
Number	Subject						C -Component
							HS -Housing System
							○ -Completed (symbol circled)
							Remarks
A.1.1.1	Vertical deflection						
(a)	Performance criteria (1D+1L+1C)			M			
.							
.							
.							
D.4.3.1	Floor-ceiling-smoke generation					C	
.							
.							
.							
E.7.3.1	Air infiltration through wall system			○			All tests documented except door infiltration
.							
.							
.							
F.8.1.1	Service life of roofing			○	C		Systems available for examination
.							
.							
.							
F.8.2.1	Water penetrations-resistance of roofing					C	
.							
.							
.							

Figure 3

SCHEDULE OF PHYSICAL TESTING

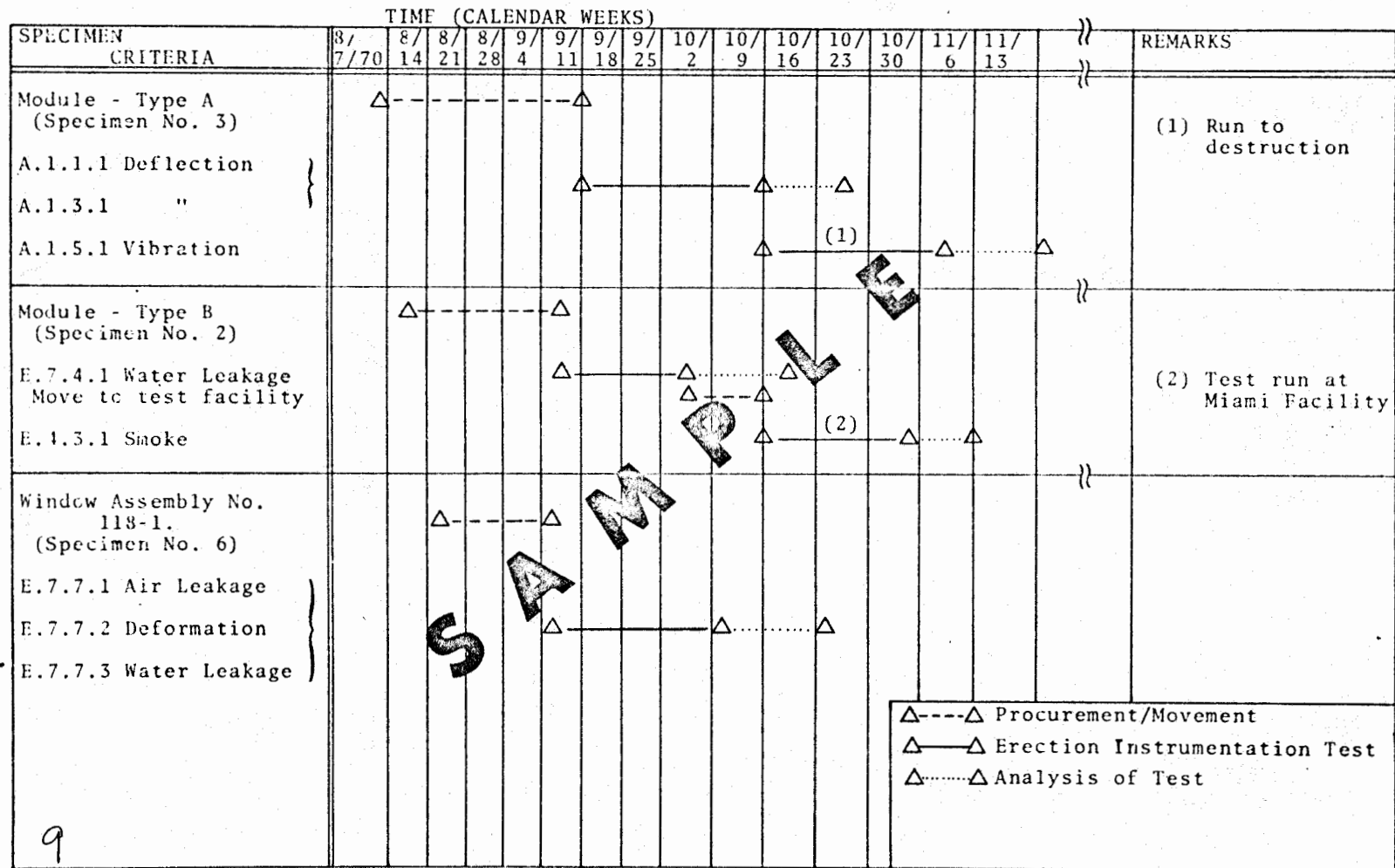


Figure 4

Housing System Producer: _____ Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u> Intercept: <u>A.1 Structure/Structural Serviceability</u>		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM <u>Legend</u> Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)
		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	
Criteria							
Number	Subject						Remarks
A.1.1.1(a)	Structure/Vert. Deflect. - Performance Criteria						
(b)1	" " " - floor (1D+1L)						
2	" " " - roof (1D+1L)						
3	" " " - floor (1D+1D+creep)						
4	" " " - roof (1D+1L+creep)						
A.1.2.1	Structure/Drift (0.9D+1W)						
A.1.2.2	Structure/Drift (1D+1L+0.8W)						
A.1.3.1(a)	Structure/Horiz. Deflect.- Performance Criteria						
(b)	" " " - Exterior Walls						
1	(0.9D+1W)						
2	(1D+1L+0.8W)						
(c)	Structure/Horiz. Deflect.- Interior Walls						
1	(1D+1L)						
2	(1D+5psf)						
A.1.4.1	Structure/Foundation Settlement (1D+1L)						
	A.1 Intercept continued on next page						

Housing System Producer: _____		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM
Building Type: Multifamily Low Rise (Guide Criteria Vol. II)		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: A.2 Structure/Structural Safety		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend
Criteria							Ma -Material
Number	Subject						C -Component
							HS -Housing System
							○ -Completed (symbol circled)
							Remarks
A.2.1.1	Structure/Load Capacity						
(a)	1.4D+1.7L						
(b)	0.9D+1.3W						
(c)	0.9D+1.45E						
(d)	1.1D+1.3L+1.3W						
(e)	1.1D+1.3L+1.45E						
(f)	0.9D+1.7Q						
A.2.1.2	Structure/Effect of creep and inelastic deflections on load capacity						
A.2.2.1	Structure/Load capacity under repeated loading						
(a)1	100 cycles: 1D to (1D+0.5L)						
2	1000 cycles: 1D to (1D+0.5W)						
(b)	5 cycles: (1D+E) to (1D-E)						
	A.2 Intercept continued on next page						

[illegible]

Housing System Producer: _____		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM Legend Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)
Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u>		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: <u>A.2 (Continued)</u>		Review of Plans/Specs.	Computations/Analysis	Test Data/Industry Cert.	Examination	Testing to be Done	Remarks
Criteria							
Number	Subject						
A.2.3.1	Structure/Sustained loading (1.2D+1.5L) for 24 hours						
(a)1	dv						
2	dh						
(b)1	dvr						
2	Dvr						
A.2.4.1	Structure/Progressive collapse (1D+0.5L)						
A.2.5.1	Structure/Effect of differential foundation settlement on load capacity						
A.2.6.1	Structure/Capacity of inserts and hangers						
(a)	Ceilings						
(b)	Structural members						
A.2.7.1	Capacity reduction by cutting for utilities						

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Housing System Producer: _____		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM <u>Legend</u> Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)
Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u>		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: <u>B.1 Interior Space Dividers-Walls and Doors, Inter-Dwelling/Structural Serviceability</u>		Review of Plans/Specs.	Computations/Analysis	Test Data/Industry Cert.	Examination	Testing to be Done	Remarks
Criteria							
Number	Subject						
B.1.1.1	Inter-dwelling walls/deflections - load supporting						
B.1.1.2	Inter-dwelling walls/deflections - non-load supporting						
B.1.2.1	Inter-dwelling walls/foundation settlement						
B.1.3.1	" " " /local damage						
(a)	150 lb anywhere						
(b)	200 lb 3in above floor						
(c)	10 psf						
(d)	Attached shelves or 40 lb/ft at eccentricity of 6in + t/2						
(e)	Impact						

Housing System Producer: _____ Building Type: Multifamily Low Rise (Guide Criteria Vol. II) Intercept: B.4 Interior Space Dividers, Walls and Doors, Inter-Dwelling/Fire Safety		Category I Evaluation of Plans & Specs. & Documentation			Category II Evaluation of Physical Elements		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM	
Criteria		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)	
Number	Subject						Remarks	
B.4.1.1	Inter-dwelling walls - fire endurance							
B.4.1.2	" " " - no through openings							
B.4.1.3	" " " - service and utility openings							
B.4.2.1	Inter-dwelling walls - flame spread							
B.4.3.1	" " " - smoke generation							
B.4.4.1	" " " - potential heat							
B.4.5.1	Fire walls - fire resistance							
B.4.5.2	" " - openings							
B.4.5.3	" " - wall-roof juncture							
B.4.6.1	" " - no continuous voids							
B.4.7.1	" " - flame spread							
B.4.8.1	" " - smoke generation							
B.4.9.1	" " - potential heat							

[illegible]

Housing System Producer: _____ Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u> Intercept: <u>C.1 Interior Space Dividers-Walls and Doors,</u> <u>Intra-Dwelling/Structural Serviceability</u>		Category I Evaluation of Plans & Specs. & Documentation			Category II Evaluation of Physical Elements		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM	
Criteria		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)	
Number	Subject						Remarks	
C.1.1.1	Intra-dwelling walls/deflections - load supporting							
C.1.1.2	Intra-dwelling walls/deflections - non-load supporting							
C.1.2.1	Intra-dwelling walls/foundation settlement							
C.1.3.1	" " " /local damage							
(a)	150 lb anywhere							
(b)	200 lb 3in above floor							
(c)	10 psf							
(d)	Attached shelves or 40 lb/ft at eccentricity of 6in + t/2							
(e)	Impact							

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Housing System Producer: _____		Category I			Category II		<p align="center">SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM</p> <p align="center"><u>Legend</u></p> <p>Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)</p>
Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u>		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: <u>E.7 Exterior Envelope-Walls, Doors and Windows/Atmospheric Environment</u>		Review of Plans/Specs.	Computations/Analysis	Test Data/Industry Cert.	Examination	Testing to be Done	Remarks
Criteria							
Number	Subject						
E.7.1.1	Exterior wall winter heat loss						
E.7.1.2	Winter total heat loss through windows						
E.7.1.3	Exterior wall summer heat gain						
E.7.1.4	Heat transmission through exposed ceilings						
E.7.2.1	Provisions for thermal breaks						
E.7.3.1	Air infiltration through exterior wall system						
E.7.4.1	No water leakage through exterior wall system						
E.7.5.1	" " " " below grade foundation						
E.7.6.1	Warm side vapor barrier						
E.7.6.2	" " " " for low permeance exterior						
E.7.7.1	Window air leakage						
E.7.7.2	No damage to window assembly from design windload						
Intercept continued on next page							

[illegible]

[illegible]

Housing System Producer: _____		Category I Evaluation of Plans & Specs. & Documentation			Category II Evaluation of Physical Elements		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM <u>Legend</u> Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)	
Building Type: Multifamily Low Rise (Guide Criteria Vol. II)								
Intercept: F.7 Exterior Envelope-Roof-Ceiling, Ground Floor/Atmospheric Environment								
Criteria		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Remarks	
Number	Subject							
F.7.1.1	Flat roof deck construction/moisture or wetting damage							
F.7.2.1	Flat roof construction/condensed moisture damage							
F.7.3.1	Attic space ventilation							
F.7.4.1	Heat transmission through exposed ceiling							
F.7.5.1	Vapor barrier under concrete slab-on-grade							
F.7.6.1	Crawl space ventilation							
F.7.6.2	Ground cover in crawl space							
F.7.7.1	Heat loss through floors over unheated spaces							

[illegible]

[illegible]

[illegible]

Housing System Producer: _____		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM
Building Type: Multifamily Low Rise (Guide Criteria Vol. II)		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: H.1 Plumbing/Structural Serviceability		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend
Criteria							Ma -Material
Number	Subject						C -Component
							HS -Housing System
							○ -Completed (symbol circled)
							Remarks
H.1.1.1(a)	Plumbing system - vertical deflections						
(b)	" " - horizontal drift						
(c)	" " - " deflection						
(d)	" " - foundation settlement						
H.1.2.1	Plumbing system vibration						
H.1.3.1(a)	Limit angular rotation of horizontal lines						
(b)	" " " " vertical lines						
(c)	Loads not to impair proper function						
(d)	No loss of stability or tightness						
H.1.3.2(a)	Fixture rims and supports to carry load						
(b)	Center loading of sump						

Housing System Producer: _____ Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u> Intercept: <u>H.3 Plumbing/Health and Safety</u>		Category I Evaluation of Plans & Specs. & Documentation			Category II Evaluation of Physical Elements		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM	
Criteria		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)	
Number	Subject						Remarks	
H.3.1.1	Minimum fixtures required							
H.3.1.2	Laundry facilities							
H.3.1.3	Service sinks or equivalent							
H.3.1.4	Floor drains or equivalent							
H.3.2.1(a)	Roughed in DWV leak test (static)							
(b)	Finished DWV leak test (static)							
(c)	" " " " (dynamic)							
(d)	Interior storm-drainage system watertightness							
(e)	Water supply system watertightness							
(f)	Safe pans and shower drains watertightness							
H.3.3.1(a)	Hot water system - supply to fixtures							
(b)	" " " - capacity and safety							
(c)	" " lines - insulation and return circulation							
(d)	" " temperature							
	Intercept H.3 continued on next page							

Housing System Producer: _____		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM	
Building Type: Multifamily Low Rise (Guide Criteria Vol. II)		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements			
Intercept: H.3 (Continued)		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend	
Criteria	Number						Subject	Ma -Material
							C -Component	HS -Housing System
							M -Module	○ -Completed (symbol circled)
							Remarks	
H.3.4.1(a)		Hot water system safety devices						
(b)1		Pressure relief valve in c-w supply						
2		Location of T and T-P relief valves						
3		Prohibited devices between relief valve and heater						
4		Location of energy shutoff devices						
H.3.5.1		Adequate but not excessive water usage						
H.3.5.2		Limit discharge rate at water outlets						
H.3.6.1		Separation between potable and non-potable water supply systems						
H.3.6.2		Air gap at water outlet						
H.3.6.3		Devices for preventing backflow						
H.3.6.4		Non-toxic materials in water supply system						
H.3.6.5		Avoid leaking drain lines above water tanks						
		Intercept H.3 continued on next page						

Housing System Producer: _____ Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u> Intercept: <u>II.3 (Continued)</u>		Category I Evaluation of Plans & Specs. & Documentation			Category II Evaluation of Physical Elements		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM Legend Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)
Criteria		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	
Number	Subject						Remarks
H.3.6.6	Avoid threaded fixture faucets and submergible connectors						
H.3.7.1	Control of vermin and rodents						
H.3.8.1(a)	Prevent emission of unsafe or unsanitary fluids						
	(b) Pneumatic pressures in DWV system						
	(c) Vent terminals - location and closure						
	(d) Area of vent terminals						
	(e) Vents to be pitched						
	(f) Avoid connections to suds zones						
H.3.9.1(a)	Capacity of drainage stacks						
	(b) Horizontal drains - flow velocity and capacity						
	(c) Interfixture hydraulic effects						
	(d) Design loads for DWV systems						
	(e) Backwater protection						
	Intercept II.3 continued on next page						

Housing System Producer: _____		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM Legend Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)
Building Type: Multifamily Low Rise (Guide Criteria Vol. II)		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: H.3 (Continued)		Review of Plans/Specs.	Computations/Analysis	Test Data/Industry Cert.	Examination	Testing to be Done	
Criteria							
Number	Subject						Remarks
H.3.9.1(f)	Indirect connections of equipment containing sterile materials						
(g)	Sub-sewer drainage						
(h)	Sub-soil drainage						
H.3.10.1(a)	Adequate discharge rates at water outlets						
(b)	Maximum water pressure and water hammer						
(c)	Water system to be designed for the available pressure						
H.3.11.1	Storm water removal by "instantaneous" or "controlled" flow						
H.3.11.2	Prevent storm drainage into sanitary sewer, or vice-versa						
H.3.11.3	Trap rain pipes and floor drains to combination						
H.3.11.4	Size combination storm-sanitary system as storm systems						
H.3.11.5	Prevent sewer backwater						

[illegible]

Housing System Producer: _____		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM
Building Type: Multifamily Low Rise (Guide Criteria Vol. II)		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: H.8 Plumbing/Durability/Time Reliability (Function)		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend
Criteria							Ma -Material C -Component M -Module
Number	Subject						Remarks
H.8.1.1	Plumbing life expectancy						
H.8.2.1(a)	Quality of materials and equipment						
(b)	Acceptability of standard and non-standard materials and equipment						
H.8.3.1	Quality of design and installation						
H.8.4.1	Self-scouring velocities in horizontal drains						
H.8.4.2	Access for cleaning drains						
H.8.4.3	Functional surfaces - cleanability and soilability						
H.8.4.4(a)	Slope of drain lines						
(b)	Avoid elements that retard flow						
(c)	Crossflow of waste water prohibited						
(d)	Maximum length of trap arms						
(e)	Avoid chilling of drain lines						
	Intercept H.8 continued on next page						

Housing System Producer: _____		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM
Building Type: Multifamily Low Rise (Guide Criteria Vol. II)		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: H.8 (Continued)		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend
Criteria							Ma -Material
Number	Subject						C -Component
							HS -Housing System
							○ -Completed (symbol circled)
							Remarks
H.8.4.4(f)	Bases of submergible vents washed by small fixtures						
(g)	Minimum sizes of dry vents below flood level						
(h)	Washing of vents to horizontal drains						
(i)	Geometrical aspects of fittings in drainage system design						
(j)	Vent grading (pitch)						
H.8.4.5(a)	Shutoff of building water supply outside building						
(b)	Interior building water supply shutoff						
(c)	Water tank shutoff						
(d)	" shutoff of each riser						
(e)	Shutoff of water supply to each dwelling unit						
(f)	Shutoff to each WC						
(g)	Water heating equipment shutoff						
	Intercept H.8 continued on next page						

Housing System Producer: _____		Category I				Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM
Building Type: Multifamily Low Rise (Guide Criteria Vol. II)		Evaluation of Plans & Specs. & Documentation				Evaluation of Physical Elements		
Intercept: H.8 (Continued)		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend	
Criteria	Number						Subject	Remarks
	H.8.4.5(h)	Shutoff devices - hydraulic characteristics						
	(i)	Draining of water supply system						
	(j)	Access for inspection and servicing						
	H.8.4.6	Pressure control of pump supplies						
	H.8.4.7	Metering of water supply						
	H.8.4.8	Pressure and temperature indicators, and control devices						
	H.8.4.9	Standby power and duplex equipment - sewage, areaway storm water and subsoil water below sewer						
	H.8.4.10	Standby power and duplex equipment - water supply						
	H.8.5.1	Freeze protection						
	H.8.6.1	External corrosion protection - piping						
	H.8.6.2	Internal " " - "						
	H.8.6.3	" " " - equipment						
	Intercept H.8 continued on next page							

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Housing System Producer: _____ Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u> Intercept: <u>I.7 Mechanical Equipment, Appliances/Atmospheric Environment</u>		Category I Evaluation of Plans & Specs. & Documentation			Category II Evaluation of Physical Elements		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM Legend Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)
Criteria		Review of Plans/Specs.	Computations/Analysis	Test Data/Industry Cert.	Examination	Testing to be Done	
Number	Subject						Remarks
I.7.1.1	Provide heating and/or cooling						
I.7.1.2(a)	Capacity to maintain 75 degrees F						
(b)	Automatic control						
(c)	Temperature and velocity variation						
(d)	Relative humidity control						
(e)	Air filtration						
(f)	Duct leakage						
I.7.1.3	Multiple heat generators						
I.7.1.4	Stand-by heating source						
I.7.1.5	Auxiliary components						
I.7.2.1	Prevent condensate on a/c supply duct						
I.7.3.1	Control humidity in high humidity areas						

Housing System Producer: _____ Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u> Intercept: <u>I.8 Mechanical Equipment, Appliances/Durability/ Time Reliability (Function)</u>		Category I Evaluation of Plans & Specs. & Documentation			Category II Evaluation of Physical Elements		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM	
Criteria		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend	
Number	Subject						Ma -Material C -Component M -Module	H -Housing Unit HS -Housing System ○ -Completed (symbol circled)
		Remarks						
I.8.1.1	Duct performance requirements							
I.8.1.2	Damage to adjacent elements caused by ducts							
I.8.2.1	HVAC - reliable operation							
I.8.2.2	" - ease of maintenance							
I.8.3.1	Elevator capacity, speed, etc.							
I.8.3.2	" safety							
I.8.3.3	" operation on emergency power							
I.8.3.4	" emergency fire operation							
I.8.4.1(a)	Range/oven - capacity and function							
(b)	" " - safety							
(c)	" " - durability and maintainability							
(d)	" " - appearance							
I.8.5.1(a)	Refrigerator - capacity and function							
(b)	" - safety							
(c)	" - durability and maintainability							
Intercept I.8 continued on next page								

Housing System Producer: _____		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM
Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u>		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: <u>I.8 (Continued)</u>		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend
Criteria	Number						Subject
	I.8.5.1(d)	Refrigerator - appearance					
	(e)	" - noise and vibration					
	I.8.6.1	Garbage and trash systems					
	I.8.6.2	Chute-type garbage and trash system					
	I.8.6.3	Garbage and trash - no incineration					
	I.8.6.4	" " " - compaction					
	I.8.6.5	" " " - fire resistant room, etc.					
	I.8.6.6	" " " - impact resistance					
	I.8.7.1	Mechanical equipment - function and adequacy					
	I.8.7.2	" " - safety					
	I.8.7.3	" " - air pollution					
	I.8.7.4	" " - noise and vibration					
	I.8.7.5	" " - structural service-					
	I.8.7.6	ability and safety Mechanical equipment - durability and reliability					
	I.8.7.7	Mechanical equipment - maintainability					

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Housing System Producer: _____		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM
Building Type: Multifamily Low Rise (Guide Criteria Vol. II)		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: J.8 Power, Electrical Distribution, Communications/Durability/Time Reliability (Function)		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	Legend
Criteria	Number						Subject
							Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)
	J.8.1.1	Main breaker capacity					
	J.8.1.2	" " - conformance to N.E.C.					
	J.8.2.1(a)	Power characteristics					
	(b)	Electrical distribution system - characteristics					
	(c)	Electrical distribution system - capacity					
	(d)	" " " - safety					
	(e)	" " " - durability					
	J.8.2.2	Emergency power - distribution					
	J.8.3.1	" electric power - need					
	J.8.3.2	" " " - automatic initiation					
	J.8.3.3	Emergency electric power - items to be powered					
	J.8.3.4	" " " - 96-hour operation					
	J.8.3.5	" " " - periodic check					
	Intercept J.8 continued on next page						

Housing System Producer: _____ Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u> Intercept: <u>J.8 (Continued)</u>		Category I Evaluation of Plans & Specs. & Documentation			Category II Evaluation of Physical Elements		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM Legend Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)
Criteria		Review of Plans/Specs.	Computations/Analysis	Test Data/Industry Cert.	Examination	Testing to be Done	
Number	Subject						Remarks
J.8.3.6	Emergency electric power - conformance to mechanical equipment requirement						
J.8.4.1	Telephone wiring						
J.8.4.2	" " - compatibility with local company						
J.8.6.1	Master TV signal distribution						
J.8.6.2	" " " " - capacity						
J.8.6.3	" " " " - construction						
J.8.6.4	" " " " - durability						

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Housing System Producer: _____		Category I			Category II		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM Legend Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)
Building Type: Multifamily Low Rise (Guide Criteria Vol. II)		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: L.3 Enclosed Spaces/Health and Safety		Review of Plans/Specs.	Computations/Analysis	Test Data/Industry Cert.	Examination	Testing to be Done	
Criteria							
Number	Subject						Remarks
L.3.1.1(a)	Elements causing falls						
(b)	Casualties from fires						
(c)	Heating and cooking equipment hazards						
(d)	Sharp edges; pointed projections, glass doors and enclosures						
(e)	Enclosed spaces openable from inside						
(f)	Fixtures and fittings securely mounted or fastened						
(g)	Ingress of insects, rodents, etc.						
(h)	Floor surfacing						
(i)	Security from criminal activity						
(j)	Lighting to provide safety						
(k)	Projecting awnings or hoods						
	L.3 Intercept continued on next page						

Housing System Producer: _____ Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u> Intercept: <u>L.3</u> (Continued)		Category I Evaluation of Plans & Specs. & Documentation			Category II Evaluation of Physical Elements		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM Legend Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)	
Criteria		Review of Plans/Specs.	Computations/Analysis	Test Data/Industry Cert.	Examination	Testing to be Done	Remarks	
Number	Subject							
L.3.2.1(a)1	Slipperiness/floor surface							
2	Change in slipperiness factor							
3	Slipperiness increases with wetting							
4	" of tub and shower surfaces							
(b)1	Rough surfaces, carpet weaves, sills, etc.							
2	Changes in floor level							
3	Stair and balcony railings							
4	Windows: ease of opening; sills, guards; cleanability							
5	Means of egress							
L.3.3.1	Personal security from criminal acts							

Housing System Producer: _____ Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u> Intercept: <u>L.4 Enclosed Spaces/Fire Safety</u>		Category I Evaluation of Plans & Specs. & Documentation			Category II Evaluation of Physical Elements		SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM Legend Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)
Criteria		Review of Plans/Specs.	Computations/ Analysis	Test Data/ Industry Cert.	Examination	Testing to be Done	
Number	Subject						Remarks
L.4.0.1	Summary table/fire criteria						
L.4.1.1	Doors - self closing/automatic closing						
L.4.1.2	" - direction of opening						
L.4.1.3	" - fire resistance						
L.4.1.4	Exit doors/temperature rise						
L.4.2.1	Exits						
L.4.2.2	" - minimum per floor						
L.4.2.3	Stairwells						
L.4.2.4	Width of corridors and stairways						
L.4.2.5	Exterior balcony used as exit						
L.4.2.6	Stairs						
L.4.2.7	Exit doors						
L.4.2.8	" signs						
L.4.2.10	Multi-level-apartments/exits/smoke detectors						
L.4.3.1	Maximum undivided area between fire walls						

Housing System Producer: _____		Category I			Category II		<p align="center">SUMMARY FORM FOR TESTING AND ANALYSIS PROGRAM</p> <p align="center"><u>Legend</u></p> <p>Ma -Material H -Housing Unit C -Component HS -Housing System M -Module ○ -Completed (symbol circled)</p>
Building Type: <u>Multifamily Low Rise (Guide Criteria Vol. II)</u>		Evaluation of Plans & Specs. & Documentation			Evaluation of Physical Elements		
Intercept: <u>L.9 Enclosed Spaces/Spatial Characteristics and Arrangement</u>		Review of Plans/Specs.	Computations/Analysis	Test Data/Industry Cert.	Examination	Testing to be Done	Remarks
Criteria							
Number	Subject						
L.9.1.1	Reference to subsequent criteria						
L.9.2.1	Living area						
L.9.3.1	Dining area						
L.9.4.1	Kitchen location						
L.9.4.2	" space						
L.9.4.3	" light and ventilation						
L.9.4.4	" range/fire protection and safety						
L.9.5.1	Laundry spaces						
L.9.6.1	Bedroom spaces						
L.9.7.1	Bathroom spaces						
L.9.8.1	Bedroom closets						
L.9.9.1	Doorways						
L.9.9.2	Habitable rooms/natural lighting and ventilation						