Water Tank Inspection Report
For
Town of New Hartford WPCA
Of the

175K Welded GST
New Hartford, CT
May 18, 2010

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INTRODUCTION

On May 18 & June 4, 2010 EXTECH representatives, Scott Leighton and Matt Budney performed corrosion and coating assessment of the exterior and interior of a steel water tank for the Town of New Hartford WPCA. The inspection was conducted to establish the current condition of the tank coatings, substrate steel, and sediment depth.

♦ Tank# 2 175K-Welded Standpipe

The tank was inspected in accordance with the latest version of AWWA D101-53-86R standard for water tank inspections, the new AWWA M42 Tank Manual and CTDPH Tank Requirements.

The tank interior was inspected while full and in operation with the TankRover remotely operated vehicle (TR). The TankRover is the only piece of equipment like it in the United States and was developed by Extech. By using the TankRover the tank was inspected with no special preparation, no additional disinfection, no confined space entry and no downtime.

The TankRover was prepared for the inspection by disinfecting in accordance with AWWA C652-02, by spray application of a 200-ppm chlorine solution prior to insertion of each tank.

The exterior portion of the tank was inspected by walking the roof, shell portions that were accessible from the ground and vertical ladder, and portions that could be inspected from the tank base. The objectives of the assessment were to:

1. Perform field inspections and tests to assess the structural and coating integrity of the tank
2. Review the safety compliance of tank ladders and access.
3. Determine if any interior coating damage was done during cellular antenna installation.
4. Formulate a report to document the assessment findings.
5. Provide recommendations for rehabilitation.
EXECUTIVE SUMMARY

The condition and recommendations for each tank are briefly summarized in this section. For detailed information regarding detailed tank conditions and the specific recommendations please refer to the designated section for each tank.

The exterior coating systems on both the roof and shell are in good condition despite moderate chalking. Mildew has stained the lower three shell rings.

The interior coating is in good condition except for the first horizontal shell weld above the floor. Numerous corrosion cells were found on this weld with small pitting. It appears that the weld was never stripe coated during the coating application process.

The tank floor has only a light accumulation of sediment with trace amounts around the perimeter. The floor coating is in very good condition.

The tank does not require maintenance at this time. There are several suggested items in the Recommendations section of this report.

The tank should be inspected in the spring of 2015 according to AWWA D-101-53-86R recommendations and current industry practice.
OBSERVATIONS

Interior and exterior photographs provided in the report were developed from a digital camera and were captured in digital format from the interior videotape. The interior images are as clear as our printing technology will allow. The interior videosnaps in the report provide a reference for our comments. Keep in mind that the videotape provides the greatest detail and should be viewed as part of the report. Each Videosnap (VS) is marked with the time stamp from the videotape. This allows the reader to easily view the original footage for each feature.

Narration on the videotape is done in the field and some of the comments may be different than the written report. The written report is the official document and contains the formal opinion of Extech.

A Posi-Tector 6000 was used to gather dry film thickness measurements on the exterior roof and shell surfaces.

Tank#2 175K Welded Standpipe

The tank was constructed in 2002 and is a welded steel structure with four shell rings. The tank dimensions are approximately 33 feet tall and 30 feet in diameter. The tank capacity is approximately 175,000 gallons.

Information was unavailable about prior maintenance or rehabilitation. Due to the relatively new tank construction it is reasonable to conclude that no prior maintenance has been performed.

Interior

The interior of the tank was accessed through one of the two 24-inch square roof hatches. The hatch used to access the tank was not locked at the time of the inspection. The hatch is equipped with a 9-inch sanitary curb and a 2-inch hatch lip.

The water level during the inspection was consistently 1-foot below the overflow.

Roof (ceiling)

The domed roof is a self-supporting structure with exterior lap welded steel plates. The roof has numerous seam corrosion areas on all welds located around the central dollar plate and radial welds see VS# 3. The knuckle welds also have prolific seam corrosion and rust staining see VS# 2. No metal loss was found on the roof welds or components. The steel plates are in good condition with intact coating and only minimal surface corrosion see DP# 21&22.
Shell

The shell coating was in very good condition except for the first horizontal weld above the floor. Numerous corrosion cells were found throughout entire circumference of this weld with some pitting see VS# 6-8. It appears that all other welds on the tank interior were stripe coated prior to the coating application see VS# 5. Only one other area of minor corrosion was found on the upper portions of the tank see VS# 4. The shell to floor seam was in very good condition see VS# 9.

Minor edge corrosion was found on the shell manway neck see VS# 11. No problems were found with the sealing surface.

Floor

The floor had only minimal sediment layer with some rust particles built up around the perimeter due to the corrosion on the first shell weld see VS# 9. No corrosion cells were found on the shell plates.

The tank has one combined inlet-outlet pipe see VS# 10. The pipe is equipped with a sediment ring that is in good condition.

Ladders

The tank is not equipped with an interior ladder.

Exterior

Roof

The exterior roof coating is in good condition with moderate chalking. The majority of the roof is intact and continuing to protect the underlying substrate see DP# 17&18.

The dry film thickness readings showed an adequate coating thickness that ranged from a low of 10.60 mils to a high of 35.60 mils with an average of 15.23 mils.

Adhesion test results were performed on the roof and according to ASTM D3359-02 method ‘B’. A 4B rating was achieved between the topcoat and the primer and the primer to the substrate see DP# 19. The results show a properly performing coating system.

Vent

The tank is equipped with one dome capped, centrally located vent see DP# 15. The vent has a 16-inch collar diameter and a 22-inch vent cap to roof distance. The vent is equipped with an exterior coarse screen and interior fine mesh bug screen, which are in good condition, see DP# 16. New bolts were installed in the vent flange as part of the inspection.
Ladders and Railings

The tank has a 16-inch wide ladder with a 12-inch rung-to-rung spacing, a 7-inch toe clearance. The ladder base is 10-feet from grade but the ladder guard covers up to the 16-ft level. The ladder has an anti-climb shield and rail climb but no safety cage see DP# 2.

The roof is equipped with a railing system with a 42-inch tall top rail, a 21-inch mid-rail and a 4-inch toe kick see DP# 14.

Shell

The shell coating is in good condition with light chalking and moderate mildew staining. The mildew staining is darkest on the first shell course but is prolific on all four shell rings see DP# 11. Overall the majority of the shell coating is intact and protecting the underlying substrate.

The coating thickness measured from a minimum of 8.20 mils to a maximum of 27.30 mils. The average paint thickness was 14.07 mils.

Overflow

The overflow pipe measures 12-inches in diameter and extends from a top shell penetration to just above grade. The outlet discharges adjacent to the tank into a catch basin and is equipped with a fine mesh screen see DP# 2-4.

Foundation

The exposed foundation top and side faces are in good face with no major cracking or spalling locations. The grouting between the chime plate and the foundation top has started the shrink and pull away in isolated locations, see DP# 9. Vegetation overgrowth was found around the tank base.

The tank is secured to the foundation with (10) anchor bolts and ½-inch chairs. Light surface corrosion was found on the anchor nuts, bolts and chairs see DP# 5-7.
RECOMMENDATIONS

Tank# 2 175K Welded Standpipe

The tank is in good overall condition however some upgrades and repairs should be performed to maintain trouble free service.

The exterior coating is in good condition but will need power washing to remove the mildew staining and sprayed with a bio-barrier material to resist future mildew growth.

The interior coating is in very good condition except for the first shell course. It appears that the metal loss is minimal and the coating should be adequate until the next inspection cycle.

The grouting between the chime plate and foundation is starting to separate from the chime in small spots but does not require repair at this time. The vegetation growing out of the foundation should be removed.

The floor surface has only minimal sediment accumulation and will not require cleaning at least until the next inspection cycle.

The tank should be inspected in the spring of 2015 in accordance with AWWA D-101-53-86R recommendations and current industry practice.

Estimated Costs:

Power wash and apply bio-barrier to exterior shell $ 1800

NACE Certified Coating Inspector  #00050
GLOSSARY OF TERMS

**Cathodic Protection** - The use of a sacrificial metal or energized substance to polarize the structures surface and prevent corrosion.

**Chalking** - The degradation of a paint system when exposed to ultra-violet light which creates a loose residue on the surface.

**Corrosion Cell** - A concentrated localized site of accelerated corrosion that creates pitting.

**Dry Film Thickness** - Total thickness of a paint film when complete cured.

**Finial Vent** - The central roof vent on top of a water tank.

**Holiday** - A hole in a protective coating that may be invisible to the unaided eye that extends to the substrate.

**Lead Abatement** - The removal and a lead bearing paint system.

**Lead Encapsulation** - The covering over of a lead based paint by applying a compatible topcoat.

**Osmotic Blister** - Raised coating area created by build up of fluid under the coating. Fluid moves through coating in response to water/solvent concentrations between coating and tank water.

**ROV** - Remotely operated vehicle, underwater inspection device “TankRover”

**Silt** - Material that accumulates in the bottom of a water tank originating from treatment by products and distribution system debris.

**Tubercle** - Domed shaped build up of corrosion products over an active corrosion site. Promotes metal loss through pitting due to differential oxygen concentrations.

**Ultrasonic Measurement** - The use of high frequency sound waves passed through a material to measure the time required to return. The time required to pass through the material is correlated to the speed of sound in the substrate to yield an actual thickness at a specific location.
Appendix A

Photographs
Tank# 2
175K
Welded Steel Standpipe
Overall view of tank.

Exterior shell ladder equipped with rail climb and anti-climb.

Overflow outlet equipped with flapper valve.

Fine screening on overflow outlet.
Spot corrosion area on anchor chair.

Closeup of spot corrosion area on anchor chair.

Surface corrosion on anchor nut and bolt.

36-inch round shell access hatch (1 of 2)
009.JPG
04/15/2010
Slight grout separation area under chime plate.

010.JPG
04/15/2010
Vegetation growing near foundation.

011.JPG
04/15/2010
Moderate mildew staining on tank base.

012.JPG
06/03/2009
24-inch roof hatch.
42-inch roof railing equipped with mid-rail and toe kick.

Roof safety railing and center roof vent.

Coarse screen outside with fine mesh under cap. All bolts replaced at time of inspection.
Left hand view of exterior roof from shell ladder

Cross cut adhesion test taken on the exterior roof

Interior dollar plate with edge corrosion
Edge corrosion on roof plate seams

Right hand view of interior roof from roof hatch

Interior overflow pipe
Town of New Hartford WPCA

175K Welded Tank

VS # 1: Overflow elbow (Time: 00:52)

VS # 2: Seam corrosion and rust staining on knuckle welds (Time: 01:35)

VS # 3: Center dollar plate with seam corrosion (Time: 03:20)
Town of New Hartford WPCA

175K Welded Tank

VS # 4: Minor area of seam corrosion on horizontal weld (Time: 09:53)

VS # 5: Typical good shell coating condition (Time: 12:06)

VS # 6: Corrosion area on lower horizontal weld after wire brushing (Time: 14:40)
VS # 7: Small pit below horizontal weld seam (Time: 17:23)

VS # 8: Numerous corrosion cells on horizontal weld seam (Time: 18:55)

VS # 9: Floor to shell seam in good condition (Time: 22:10)
Town of New Hartford WPCA

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VS # 10: Inlet/Outlet pipe with sediment ring (Time: 23:30)

VS # 11: Minor edge corrosion on neck of shell man way (Time: 23:45)
Appendix B

Dry Film Thickness Reading
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Appendix C

Adhesion Test Method 3359
Standard Test Methods for Measuring Adhesion by Tape Test\(^1\)

This standard is issued under the fixed designation D 3359; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 These test methods cover procedures for assessing the adhesion of coating films to metallic substrates by applying and removing pressure-sensitive tape over cuts made in the film.

1.2 Test Method A is primarily intended for use at job sites while Test Method B is more suitable for use in the laboratory. Also, Test Method B is not considered suitable for films thicker than 5 mils (125 µm).

Note 1—Subject to agreement between the purchaser and the seller, Test Method B can be used for thicker films if wider spaced cuts are employed.

1.3 These test methods are used to establish whether the adhesion of a coating to a substrate is at a generally adequate level. They do not distinguish between higher levels of adhesion for which more sophisticated methods of measurement are required.

Note 2—It should be recognized that differences in adhesiveness of the coating surface can affect the results obtained with coatings having the same inherent adhesion.

1.4 In multicoat systems adhesion failure may occur between coats so that the adhesion of the coating system to the substrate is not determined.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 This standard does not purport to address the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards:
D 609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products\(^2\)
D 823 Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels\(^2\)
D 1000 Test Method For Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications\(^3\)
D 1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting\(^4\)
D 2092 Guide for Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting\(^5\)
D 2370 Test Method for Tensile Properties of Organic Coatings\(^2\)
D 3330 Test Method for Peel Adhesion of Pressure-Sensitive Tape\(^6\)
D 3924 Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials\(^2\)
D 4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser\(^2\)

3. Summary of Test Methods

3.1 Test Method A—An X-cut is made through the film to the substrate, pressure-sensitive tape is applied over the cut and then removed, and adhesion is assessed qualitatively on the 0 to 5 scale.

3.2 Test Method B—A lattice pattern with either six or eleven cuts in each direction is made in the film to the substrate, pressure-sensitive tape is applied over the lattice and then removed, and adhesion is evaluated by comparison with descriptions and illustrations.

4. Significance and Use

4.1 If a coating is to fulfill its function of protecting or decorating a substrate, it must adhere to it for the expected service life. Because the substrate and its surface preparation (or lack of it) have a drastic effect on the adhesion of coatings, a method to evaluate adhesion of a coating to different substrates or surface treatments, or of different coatings to the

\(^{1}\) These test methods are under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and are the direct responsibility of Subcommittee D01.23 on Physical Properties of Applied Paint Films.

\(^{2}\) Annual Book of ASTM Standards, Vol 06.01.

\(^{3}\) Annual Book of ASTM Standards, Vol 10.01.

\(^{4}\) Annual Book of ASTM Standards, Vol 02.05.

\(^{5}\) Annual Book of ASTM Standards, Vol 06.02.

same substrate and treatment, is of considerable usefulness in
the industry.

4.2 The limitations of all adhesion methods and the specific
limitation of this test method to lower levels of adhesion (see
1.3) should be recognized before using it. The intra- and
inter-laboratory precision of this test method is similar to other
widely-accepted tests for coated substrates (for example, Test
Method D 2370 and Test Method D 4060), but this is partly
the result of it being insensitive to all but large differences in
adhesion. The limited scale of 0 to 5 was selected deliberately
to avoid a false impression of being sensitive.

TEST METHOD A—X-CUT TAPE TEST

5. Apparatus and Materials

5.1 Cutting Tool—Sharp razor blade, scalpel, knife or other
cutting devices. It is of particular importance that the cutting
edges be in good condition.

5.2 Cutting Guide—Steel or other hard metal straightedge
to ensure straight cuts.

5.3 Tape—25-mm (1.0-in.) wide semitransparent pressure-
sensitive tape7 with an adhesion strength agreed upon by the
supplier and the user is needed. Because of the variability in
adhesion strength from batch-to-batch and with time, it is
essential that tape from the same batch be used when tests are
to be run in different laboratories. If this is not possible the
test method should be used only for ranking a series of test
coatings.

5.4 Rubber Eraser, on the end of a pencil.

5.5 Illumination—A light source is helpful in determining
whether the cuts have been made through the film to the
substrate.

6. Test Specimens

6.1 When this test method is used in the field, the specimen
is the coated structure or article on which the adhesion is to be
evaluated.

6.2 For laboratory use apply the materials to be tested to
panels of the composition and surface conditions on which it is
desired to determine the adhesion.

Note 3—Applicable test panel description and surface preparation
methods are given in Practice D 609 and Practices D 1730 and D 2002.

Note 4—Coatings should be applied in accordance with Practice
D 823, or as agreed upon between the purchaser and the seller.

Note 5—If desired or specified, the coated test panels may be subjected to
a preliminary exposure such as water immersion, salt spray, or high
humidity before conducting the tape test. The conditions and time of
exposure will be governed by ultimate coating use or shall be agreed upon
between the purchaser and seller.

7. Procedure

7.1 Select an area free of blemishes and minor surface
imperfections. For tests in the field, ensure that the surface is
clean and dry. Extremes in temperature or relative humidity
may affect the adhesion of the tape or the coating.

7.1.1 For specimens which have been immersed: After
immersion, clean and wipe the surface with an appropriate
solvent which will not harm the integrity of the coating. Then
dry or prepare the surface, or both, as agreed upon between the
purchaser and the seller.

7.2 Make two cuts in the film each about 40 mm (1.5 in.)
long that intersect near their middle with a smaller angle of
between 30 and 45°. When making the incisions, use the
straightedge and cut through the coating to the substrate in one
steady motion.

7.3 Inspect the incision for reflection of light from the
metal substrate to establish that the coating film has been
penetrated. If the substrate has not been reached make another
X in a different location. Do not attempt to deepen a previous
cut as this may affect adhesion along the incision.

7.4 Remove two complete laps of the pressure-sensitive
tape from the roll and discard. Remove an additional length at a
steady (that is, not jerked) rate and cut a piece about 75 mm
(3 in.) long.

7.5 Place the center of the tape at the intersection of the cuts
with the tape running in the same direction as the smaller
angles. Smooth the tape into place by finger in the area of the
incisions and then rub firmly with the eraser on the end of a
pencil. The color under the transparent tape is a useful
indication of when good contact has been made.

7.6 Within 90 ± 30 s of application, remove the tape by
seizing the free end and pulling it off rapidly (not jerked) back
upon itself at an angle of 180° as possible.

7.7 Inspect the X-cut area for removal of coating from the
substrate or previous coating and rate the adhesion in accord-
cance with the following scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0A</td>
<td>No peeling or removal,</td>
</tr>
<tr>
<td>1A</td>
<td>Removal from most of the area of the X under the tape,</td>
</tr>
<tr>
<td>2A</td>
<td>Jagged removal along most of incisions up to 3.2 mm (1/8 in.) on either side,</td>
</tr>
<tr>
<td>3A</td>
<td>Jagged removal along incisions up to 1.0 mm (1/32 in.) on one side,</td>
</tr>
<tr>
<td>4A</td>
<td>Trace peeling or removal along incisions or at their intersection,</td>
</tr>
</tbody>
</table>

7.8 Repeat the test in two other locations on each test panel.
For large structures make sufficient tests to ensure that the
adhesion evaluation is representative of the whole surface.

7.9 After making several cuts examine the cutting edge and,
if necessary, remove any flat spots or wire-edge by abrading
lightly on a fine oil stone before using again. Discard cutting
tools that develop nick or other defects that tear the film.

8. Report

8.1 Report the number of tests, their mean and range, and
for coating systems, where the failure occurred that is, between
first coat and substrate, between first and second coat, etc.

8.2 For field tests report the structure or article tested, the
location and the environmental conditions at the time of
testing.

8.3 For test panels report the substrate employed, the type of
coating, the method of cure, and the environmental conditions
at the time of testing.

8.4 If the adhesion strength of the tape has been determined
in accordance with Test Methods D 1000 or D 3330, report the

7 Pernacel 99, manufactured by Pernacel, New Brunswick, NJ 08903, and
available from various Pernacel tape distributors, is reported to be suitable for this
purpose. The manufacturer of this tape and the manufacturer of the tape used in the
interlaboratory study (see IR: 1001-1008), have advised this subcommittee that the
properties of these tapes were changed. Users of it should therefore, check whether
current material gives comparable results to previous supplied material.
results with the adhesion rating(s). If the adhesion strength of
the tape has not been determined, report the specific tape used
and its manufacturer.

8.5 If the test is performed after immersion, report immersion
conditions and method of sample preparation.

9. Precision and Bias

9.1 In an interlaboratory study of this test method in which
operators in six laboratories made one adhesion measurement
on three panels each of three coatings covering a wide range of
adhesion, the within-laboratories standard deviation was found
to be 0.33 and the between-laboratories 0.44. Based on these
standard deviations, the following criteria should be used for
judging the acceptability of results at the 95% confidence
level:

9.1.1 Repeatability—Provided adhesion is uniform over a
large surface, results obtained by the same operator should be
considered suspect if they differ by more than 1 rating unit for
two measurements.

9.1.2 Reproducibility—Two results, each of the mean of tripli-
cicates, obtained by different operators should be considered
suspect if they differ by more than 1.5 rating units.

9.2 Bias cannot be established for these test methods.

TEST METHOD B—CROSS-CUT TAPE TEST

10. Apparatus and Materials

10.1 Cutting Tool—Sharp razor blade, scalpel, knife or
other cutting device having a cutting edge angle between 15
and 30° that will make either a single cut or several cuts at
once. It is of particular importance that the cutting edge or
edges be of good condition.

10.2 Cutting Guide—If cuts are made manually (as opposed
to a mechanical apparatus) a steel or other hard metal straight-
edge or template to ensure straight cuts.

10.3 Rule—Tempered steel rule graduated in 0.5 mm for
measuring individual cuts.

10.4 Tape, as described in 5.3.

10.5 Rubber Eraser, on the end of a pencil.

10.6 Illumination, as described in 5.5.

10.7 Magnifying Glass—An illuminated magnifier to be
used while making individual cuts and examining the test area.

11. Test Specimens

11.1 Test specimens shall be as described in Section 6. It
should be noted, however, that multlip cutters provide good
results only on test areas sufficiently plane that all cutting edges
contact the substrate to the same degree. Check for flatness
with a straight edge such as that of the tempered steel rule
(10.3).

12. Procedure

12.1 Where required or when agreed upon, subject the speci-
mens to a preliminary test before conducting the tape test
(see Note 3). After drying or testing the coating, conduct the
tape test at room temperature as defined in Specification
D 3924, unless D 3924 standard temperature is required or
agreed.

12.1.1 For specimens which have been immersed: After
immersion, clean and wipe the surface with an appropriate
solvent which will not harm the integrity of the coating. Then
dry or prepare the surface, or both, as agreed upon between the
purchaser and the seller.

12.2 Select an area free of blemishes and minor surface
imperfections, place on a firm base, and under the illuminated
magnifier, make parallel cuts as follows:

12.2.1 For coatings having a dry film thickness up to and
including 2.0 mils (50 μm) space the cuts 1 mm apart and make
eleven cuts unless otherwise agreed upon.

12.2.2 For coatings having a dry film thickness between 2.0
mils (50 μm) and 5 mils (125 μm), space the cuts 2 mm apart
and make six cuts. For films thicker than 5 mils use Test
Method A.

12.2.3 Make all cuts about 20 mm (3/4 in.) long. Cut through
the film to the substrate in one steady motion using just
sufficient pressure on the cutting tool to have the cutting edge
reach the substrate. When making successive single cuts with the
aid of a guide, place the guide on the uncut area.

12.3 After making the required cuts brush the film lightly
with a soft brush or tissue to remove any detached flakes or
ribbons of coatings.

12.4 Examine the cutting edge and, if necessary, remove
any flat spots or wire-edge by abrading lightly on a fine oil
stone. Make the additional number of cuts at 90° to and
centered on the original cuts.

12.5 Brush the area as before and inspect theincisions for
reflection of light from the substrate. If the metal has not been
reached make another grid in a different location.

12.6 Remove two complete laps of tape and discard. Re-
move an additional length at a steady (that is, not jerked) rate
and cut a piece about 75 mm (3 in.) long.

12.7 Place the center of the tape over the grid and in the area
of the grid smooth into place by a finger. To ensure good
contact with the film rub the tape firmly with the eraser on the
end of a pencil. The color under the tape is a useful indica-
tion of when good contact has been made.

12.8 Within 90 ± 30 s of application, remove the tape by
seizing the free end and rapidly (not jerked) back upon itself at
as close to an angle of 180° as possible.

12.9 Inspect the grid area for removal of coating from the
substrate or from a previous coating using the illuminated
magnifier. Rate the adhesion in accordance with the following
scale illustrated in Fig. 1:

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8 Supporting data are available from ASTM International Headquarters. Request
RR: D01-1008.
9 Multilple cutters are available from a few sources that specialize in testing
equipment for the paint industry. One supplier that has assisted in the refinement of
these methods is given in footnote 10.
10 The sole source of supply of the multilple cutter for coated pipe surfaces known
to the committee at this time is Paul N. Gardner Co., 316 NE First St., Pompano
Beach, FL 33409. If you are aware of alternative suppliers, please provide this
information to ASTM International Headquarters. Your comments will receive
careful consideration at a meeting of the responsible technical committees, which
you may attend.
The edges of the cuts are completely smooth; none of the squares of the lattice is detached.

Small flakes of the coating are detached at intersections; less than 5% of the area is affected.

Small flakes of the coating are detached along edges and at intersections of cuts. The area affected is 5 to 15% of the lattice.

The coating has flaked along the edges and on parts of the squares. The area affected is 15 to 35% of the lattice.

The coating has flaked along the edges of cuts in large ribbons and whole squares have detached. The area affected is 35 to 65% of the lattice.

Flaking and detachment worse than Grade 1.

12.10 Repeat the test in two other locations on each test panel.

13. Report

13.1 Report the number of tests, their mean and range, and for coating systems, where the failure occurred, that is, between first coat and substrate, between first and second coat, etc.

13.2 Report the substrate employed, the type of coating and the method of cure.

13.3 If the adhesion strength has been determined in accordance with Test Methods D 1000 or D 3330, report the results with the adhesion rating(s). If the adhesion strength of the tape has not been determined, report the specific tape used and its manufacturer.

13.4 If the test is performed after immersion, report immersion conditions and method of sample preparation.

14. Precision and Bias

14.1 On the basis of two interlaboratory tests of this test method in one of which operators in six laboratories made one adhesion measurement on three panels each of three coatings covering a wide range of adhesion and in the other operators in six laboratories made three measurements on two panels each of four different coatings applied over two other coatings, the pooled standard deviations for within- and between-laboratories were found to be 0.37 and 0.7. Based on these standard deviations, the following criteria should be used for judging the acceptability of results at the 95% confidence level:

14.1.1 repeatability — Provided adhesion is uniform over a large surface, results obtained by the same operator should be considered suspect if they differ by more than one rating unit for two measurements.

14.1.2 Reproducibility — Two results, each the mean of duplicates or triplicates, obtained by different operators should be considered suspect if they differ by more than two rating units.

14.2 Bias cannot be established for these test methods.

15. Keywords

15.1 adhesion; crosscut adhesion test method; tape; tape adhesion test method; X-cut adhesion test method