

NONRESIDENTIAL MARKET SHARE TRACKING STUDY

APPENDIX J PHASE 2 LIST OF QUALITY CONTROL CHECKS

Prepared For:
California Energy Commission

Prepared By:
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With
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Robert Thomas Brown Company**



CONSULTANT REPORT

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CEC 400-2005-013-AP10

Note: The following Quality Control Specifications refer to the Phase II - v2.s - 01/07/03 Industrial Energy End-User Survey ONLY

In the equivalent manner for the Phase 1 survey, Aspen will be verifying that completed questionnaires meet the below quality assurance checks so that we can be confident that the data used in analysis for the CEC is of high quality. There are six general types of quality checks that Aspen is applying:

1. Completeness checks

Ensure questions are answered.

Example: Have you received energy training in the last two years...? Must be answered with exactly one box checked: Yes, No, or Not Sure.

2. Skip checks

Ensure that the surveyors asks appropriate questions based on response to initial questions.

Example: If customer does not buy rewound motors, questions about rewinding practices should be skipped.

3. Range checks

Ensure that numeric answers are in a plausible range. May be a function of answers to multiple questions.

Example: How many of the last 5 motors....? Answer must be between 0 and 5.

Example: Motor efficiency must be at least as high as CFR required minimums for new motors. The minimum is a function of motor hp and year of manufacture.

4. Cross checks

Ensure that answers to questions make sense with one another, particularly multiple choice questions.

Example: If optimal compressor sequencing controls are used, multiple compressors should be listed in the inventory.

Example: Motor year of manufacture should not be later than year bought.

5. Ratio checks

Ensure that numeric answers to questions are of the right magnitude relative to one another.

Example: Total new motor hp installed in the last 3 years does not exceed estimated total plant hp.

6. Qualitative check of respondent

Provide a response that gauges the quality of the responses provided by the respondent.

Example: Assess whether the responses seem to very reliable.

Compare Screener Responses of Technologies On-Site with those Recorded in the On-site Questionnaire

First look at the screener responses to find out which technologies the respondent said they had of motors >1 hp, pumps, compressed air, electronic process control, gas process heating, water recovery, refrigeration, and power generation. Look for the applicable section in the questionnaire. If not completed, look for explanation in the margin of the first page of that section.

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Cover Page	
Business name	Must be completed, with the full corporate name.
Address	Must be completed. Include building name or number for main office area
Survno	Must be entered from Profile page
SIC Code from Frame	Enter from Profile page
Utility Territory	Enter PG&E, SCE, or SDG&E
Site Visit Date	Between 12/2/02 and 12/31/03
Time Arrived	Must be completed.
Time Left	Must be completed.
Site Visit Contacts	Must be completed. Include position titles and staple business card(s) to survey, if available
Phone #	Must be completed. Include phone extension(s) of contact persons

General		
Q	Page	Notation
1	2	Provide a detailed description of the product(s), not the process. [Necessary for 4-digit SIC coding.]
2	2	Enter year between 1900 and 2002
3	2	Enter rounded \$ figure. Note if it makes sense for plant size. Must provide \$ to benchmark. Note: If Closing section Q1 answered "No", this question is still required because Closing section Q1 refers to energy use per \$ value of output, not the same as this question. If Closing section Q1 answered "Yes" but failed to answer this question, it is not an error because these are different questions.
4	2	Explain meaning and calculation of FTE. If only number of employees is known, show this number separately on this page
5	3	Range is 1 to 4 shifts/day. Fractions okay. Note: Answers for Saturday and Sunday are not required.
6	3	Enter square feet value representing all buildings controlled by a common plant manager/decision-maker, on utility meter(s) at this location. Refer to the definition below: A manufacturing establishment is defined as "all buildings in a contiguous area that are controlled by a common decision-maker regarding energy." The plant may produce one or multiple products. There typically is one plant manager, and one maintenance staff.
7	3	Enter the response, preferably no more than 2. If Other is completed, ask if the name could be one of the available department selections.
8	4	Enter only one box.
9	4	Enter one with best estimate of percentage increase of production, not staff.
10	4	Enter percentage figures for all buildings at this location. For estimates, include respondent's wording.
11	4	Enter only one box that refers to equipment for the production process.
12	4	Enter only one box with \$ limit if provided.
13	5	Request figures for electric and fuels used. If fuel is "Other", write in which fuel was purchased. Note: We will have to tell the surveyors to circle Other and write it in if fuel is "Other". And if "Other" is circled, it can only select among "\$_/yr other" or "not sure", or "Refused". Other has more options. <u>"Other" could be:</u> Steam 1,000lbs Coal Tons Chillered Water Ton Hours Wood Tons
14	5	Enter only one box.
15	5	If Q14 = Yes, enter as many as respondent provides. If training topic is a technical subset of one of the selections, check topic listed and write in specific training focus. This list will not be adding to the questionnaire. This is to be provided to the surveyors so that they can "link" these technical subsets to one of those listed.

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Motors

Q	Page	Notation
1	7	Enter either box. Write in respondent's different definition, if provided.
2	7	Enter the one box that reflects the respondent's answer.
3	8	Enter only one box.
4	8	Enter only one box.
5	8	If none, move to Q6. If the number of Special ordered motors bought was 5 or less, this question requires that this value be equal to the sum of the individual numbers of Premium efficiency plus Non-premium efficiency motors.
6	8	Emphasize = or > 50hp & last 3 years; request a single number or rough estimate. Note on page 17 on reasonable hp size compared to facility size for data comparability only (not for error flagging).
7	9	Emphasize >1 and <50 hp and last 3 years; request a single number or rough estimate.
8	9	Note this asks for total hp in each category. Basis is sum of motors given in Q6 + Q7. Skip if Q6 AND Q7 are 0.
9	9	Exactly one boxed checked.
10	9	If Q9 = Sometimes rewind, enter as many as respondent provides. If explanation for "Other" is a technical subset of one of the selections, check topic listed and write in specific reason. Q10 thru Q13 are blank if Q9 is "always replace" Note: Q10 thru Q13 should be blank unless Q9 = "Sometimes rewind"
11	9	Not a firm rule, but unusual if less than 5 hp, and would like comment if less than 1 hp. Note: No need to create exception record based on the reviews of the Phase 1 surveys, ~ 30% were <5 hp, and no comments added.
12	10	Enter 0-5, Not Sure or "Don't know" box
13	10	Check all boxes that apply.
14	10	Emphasize total of existing adjustable flow fans & pumps. Suggest range if in doubt. Response needs to be recorded, even if answer is "Don't Know."
15	11	Motors currently controlled by operating VSDs are the intent. Q15 is always equal or less than Q14. If response is 0 or DK, go to Q19.
16	11	Emphasize last 3 years , and the same VSDs on the motors in Q15. Q16 must be less than or equal to Q15. If response for Q16 > Q15, ask if all VSDs installed are in operation today. Not mandatory hard rule because could have non variable flow VSDs.
17	11	Check all boxes that apply. Include "Other" if it is distinct from other selections.
18	11	Enter one box only in right hand column.
19	12	Check all boxes that apply. If "Other", ask if title fits one of the selections. Note: Mid to larger companies often had more than one person involved, so allowing multiple responses will capture that.
20	12	If asked, indicate preference for only one box checked, not counting "lowest bidder"
21	12	Enter one box for each of the 3 sub topics
22	13	Check all boxes that apply.
23	14	If random number table and sketch is used to select motors, include these with the completed survey.
23	16	Number of motors inventoried should be = or < sum of numbers in Q6 + Q7. Motor sampling method is required.
	16	Most valuable parameters, in order, are hp, efficiency, year bought, enclosure, then remaining data. Each row and needed data is listed below: Motor Table row heading titles are <u>underlined</u>

Location: Descriptive identified or Room name is preferred [e.g. Compressor Room, Cooling Tower, etc.]

Motor Make: Name of manufacturer

VSD in Use? Check yes if VSD is operating and variable flow make sense for machine type (compressor, fan, press, etc.)

Variable-flow pumps and fans? Check yes only if VSD controls pumps and fans

NOTE: Variable flow shouldn't have any boxes checked if no hp shown for VSDs in Q15

Year Bought Enter one of the years: 2000, 2001, or 2002

Motor Year of Manufacture on Nameplate: Confirm it is 2000 or more recent

Range for year of Manufacture 1930-2002. If <1998, flag as installation of a used motor.

Note: check "Why bought" and allow only 2nd or 3rd choice if Yr of Manufacture is <1998.

The version of the motor page that I based this Q/C spec shows the 4th choice is "Came with used..

If year manufactured is < 1998, then year bought >= 1998

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Output Power hp Required data, list number from nameplate. Only survey motors of at least 1 hp or at least 0.7 kW each.
NOTE: Circle if units are kW, not hp.

Enclosure Check one only

RPM: Nameplate values typically slightly less than 600, 900, 1200, 1800, or 3600 RPM
RPM is normally in the range 500-600, 800-900, 1100-1200, 1700-1800, or 3400-3600.
Note: the program no need to flag RPM if not in one of these ranges, as there are certain machines that do not operate in these ranges (milling machines, etc.)

Volts (V): Single number, (usually the bigger of the two stamped numbers).
Voltage commonly expected values: 110-120 for 1 hp motors, 230, 240, 460, 480 for all motor sizes. 460 most common.

=if hp >= 5 then volts (>=208 and <=240) or (>=440 and <= 480) Note: this is a change.
=if hp < 5 then volts (>=208 and <=240) or (>=440 and <= 480) or (>=110 and <=120) Note: this is a change.
Note: These ranges were in the Ph 1 Q/C specs, but may have been for guidance only. Do NOT add coding for Ph 2.

Phase is 1 or 3

Efficiency: At least that shown in table A1 & less than 100%.

Approximate formula format instead of table:

=if hp < 1.5, then eff >0.75
=if hp >=1.5 and hp < 5, then eff > 0.82
=if hp >=5 then eff >= 0.91+0.00018*hp - 0.31/hp

Table A1

Motor Hp	Min Eff.	
1	75.5%	0.600
1.5	82.5%	0.704
2	84.0%	0.755
3	84.0%	0.807
5	85.5%	0.849
7.5	87.5%	0.870
10	88.5%	0.881
15	89.5%	0.892
20	90.2%	0.898
25	91.0%	0.902
30	91.0%	0.905
40	91.7%	0.909
50	92.4%	0.913
60	93.0%	0.916
75	93.0%	0.919
100	93.0%	0.925
125	93.6%	0.930
150	93.6%	0.935
200	94.5%	0.944

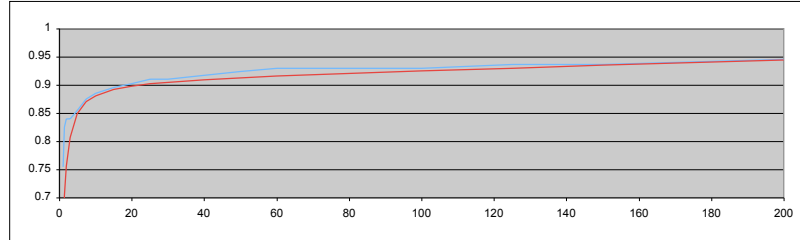


Table A2	Average Power Factor
1	71
1.5	73
2	79
3	78
5	79
7.5	76
10	79
15	80
20	86
25	84
30	86
40	85
50	85
60	86
75	87
100	87
125	88
150	88
200	88

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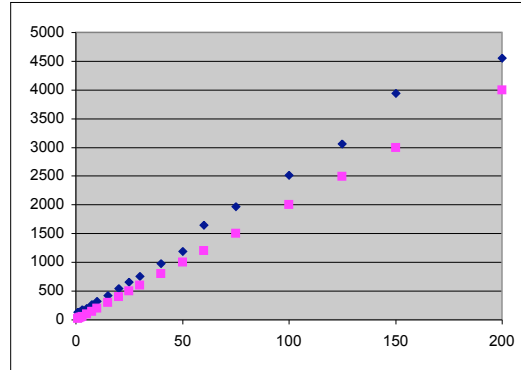
Power Factor: Show percentage of PF at full load.

Power factor is between 60% and 99%. Manual checks include expectations of lower values for smaller motors, bigger for bigger. Table A2 shows average power factor figures
 Motor (Only) Purchase Price: Round up to closest figure. Table B show Price in reasonable ranges and is not cost for entire packaged equipment.

Table B

HP	Min (40% of list)	Max (150% of list)
1	\$133	\$699
1.5	\$136	\$804
2	\$146	\$893
3	\$174	\$602
5	\$200	\$885
7.5	\$269	\$1,113
10	\$319	\$1,512
15	\$425	\$1,857
20	\$540	\$1,929
25	\$657	\$2,373
30	\$763	\$2,955
40	\$976	\$4,503
50	\$1,186	\$4,833
60	\$1,645	\$5,958
75	\$1,968	\$8,591
100	\$2,522	\$9,701
125	\$3,064	\$13,727
150	\$3,943	\$16,164
200	\$4,560	\$19,887
Over 200	\$4,560	\$41,770

133.2	699	\$20
135.6	804	\$30
146.4	892.5	\$40
174.0	601.5	\$60
200.0	885	\$100
269.2	1113	\$150
319.2	1512	\$200
425.2	1857	\$300
540.4	1929	\$400
656.8	2373	\$500
762.8	2955	\$600
975.6	4503	\$800
1,186.0	4833	\$1,000
1,645.2	5958	\$1,200
1,967.6	8590.5	\$1,500
2,522.0	9700.5	\$2,000
3,064.4	13726.5	\$2,500
3,943.2	16164	\$3,000
4,560.0	19887	\$4,000



Typical	List Price (Take 1/3 off typ.)*		
	HP	Std	Eff.
\$533	1	\$333	\$466
\$583	1.5	\$339	\$536
\$641	2	\$366	\$595
\$557	3	\$435	\$401
\$727	5	\$500	\$590
\$943	7.5	\$673	\$742
\$1,204	10	\$798	\$1,008
\$1,534	15	\$1,063	\$1,238
\$1,758	20	\$1,351	\$1,286
\$2,149	25	\$1,642	\$1,582
\$2,585	30	\$1,907	\$1,970
\$3,627	40	\$2,439	\$3,002
\$4,125	50	\$2,965	\$3,222
\$5,390	60	\$4,113	\$3,972
\$7,097	75	\$4,919	\$5,727
\$8,515	100	\$6,305	\$6,467
\$11,208	125	\$7,661	\$9,151
\$13,756	150	\$9,858	\$10,776
\$16,439	200	\$11,400	\$13,258
	Over 200	\$14,474	\$16,416

*Ref MotorMaster+ 3.0 dated 12/9/02

Why bought?: Select one or write in other reason(s) on page 17.

Reason(s) bold field(s) missing: Select one as applicable

Note: Since there may be multiple fields missing, we should not allow multiple reasons to be checked.

Notes on condition, use, etc. Add explanatory information to supplement the motor table data

Q
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Page

Notation

For used equipment only, check one box and add explanation if provided.

Note: Should not allow multiple reasons to be checked

allow multiple responses to identify different purchase patterns

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Process Fluid Pumping Systems

Q	Page	Notation
1	22	Enter only one box. Emphasize the 50 hp is for the manufacturing process only and excludes back-up or redundant pump.
2	22	Emphasize total pumping hp for process loads. Suggest range if in doubt. Response needs to be recorded, even if answer is "Don't Know."
3	22	Check none, enter number (check for reasonable figure based on plant size), suggest estimate or DK.
4	22	Q4 < or = Q2.
5	23	Check all that apply. Emphasize changes made and if in last 3 years
	23	Add explanatory information on the pumping system to supplement the data in this section.

Compressed Air System

Q	Page	Notation																																																
1	25	One box is checked. Rest of section is blank if "No."																																																
2	25	Check: Total hp = or > 50 hp not counting backup units One operating condition per row In most cases expect exactly one modulating unit. In most cases one backup unit only. If VSD is checked then the motor hp is no more than the hp in motors section Q15 or Q16. In most cases no more than one compressor has VSD control																																																
3	26	Exactly one checked. <i>Typical control type by manufacturer</i> <i>("P" primary or most common, "S" is secondary or less common for that brand)</i>																																																
		<table border="1"> <thead> <tr> <th>Brand</th> <th>Throttle</th> <th>Slide/poppet/turn</th> <th>Cycling</th> <th>VSD</th> <th>Bypass</th> </tr> </thead> <tbody> <tr> <td>Atlas-Copco</td> <td></td> <td></td> <td>P</td> <td>S</td> <td></td> </tr> <tr> <td>Gardner-Denver</td> <td></td> <td>P</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Ingersoll-Rand</td> <td></td> <td></td> <td></td> <td>S</td> <td></td> </tr> <tr> <td>Kaeser</td> <td>P</td> <td></td> <td>S</td> <td></td> <td></td> </tr> <tr> <td>Quincy</td> <td>S</td> <td>S</td> <td>P</td> <td>S</td> <td></td> </tr> <tr> <td>Sullair</td> <td></td> <td>P</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Centrifugal, all brands</td> <td>S</td> <td></td> <td></td> <td></td> <td>P</td> </tr> </tbody> </table>	Brand	Throttle	Slide/poppet/turn	Cycling	VSD	Bypass	Atlas-Copco			P	S		Gardner-Denver		P				Ingersoll-Rand				S		Kaeser	P		S			Quincy	S	S	P	S		Sullair		P				Centrifugal, all brands	S				P
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Kaeser	P		S																																															
Quincy	S	S	P	S																																														
Sullair		P																																																
Centrifugal, all brands	S				P																																													
4	26	Exactly one checked. If "Yes" or "Not sure," more than one compressor must be listed in Q2.																																																
5	26	Exactly one checked.																																																
6	26	Exactly one checked.																																																
7	26	Explain this is the downstream, air-using equipment pressure. If response is > Q8, ask for their explanation																																																
8	27	Explain this is the air pressure leaving the compressor. Range is typically 80 to 150 psia																																																
9	27	Text response required if Q8-Q7 > 10																																																
10	27	Exactly one checked. 10b is less than Q8. Or, Q10c is greater than Q8.																																																
11	27	Blank if Q10 NOT Decreased. Completed otherwise.																																																
12	28	Exactly one checked.																																																
13	28	Completed if Q12 Response Other than Never																																																
14	28	Completed if Q12 Response Other than Never Note: Actually, Q14 does not require a previous positive or negative response.																																																
15	28	Exactly one checked.																																																
16	28	Text response required if Q15 = Yes																																																
17	29	Exactly one checked.																																																
18	29	Text response required if Q15 = Yes																																																
19	29	Yes for 19a and 19b is acceptable, or NO with check on reasons or Not Sure																																																
20	29	Enter \$\$ or DK																																																
21	30	Multiple response acceptable																																																
22	30	Multiple response acceptable																																																

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Maintenance

Q	Page	Notation
1	32	One box checked per row
2	32	Compare the number of staff assigned full time to maintenance with that plant employment (General Section Q4). Check that maintenance staff is within the expected range defined by: Total plant emp. Allowed % of total staff as miantenance FTEs 1 to 5 80% = 1 to 4 6 to 10 50% = 3 to 5 11 to 20 40% = 4 to 8 21 to 50 20% = 4 to 10 over 50 10% = 5 and more Write in the response and compute FTE in the space provided.
3	32	Exactly one checked.
4	33	Exactly one checked.
5	33	Text response required if Q4 is increase or decrease
6	33	Exactly one checked.
7	33	Enter number greater than 1, for all fans and blowers. If response is no blowers, check "none", not "0". Note: The range checks for this equipment is identified on the last page
8	34	Exactly one checked.
9	34	Skipped if Q8 is No or Not sure. Completed otherwise. Greater than 0. Small enough for facility size.
10	34	Skipped if Q8 is No or Not sure. Multiple responses acceptable.
11	34	Skipped if Q8 is No or Not sure. Exactly one checked otherwise.
12	35	Skipped if Q8 is No or Not sure. Multiple responses acceptable.
13	35	One box checked per row. Automatic lubrication only checked if Q8 is yes. Note: Retain refrigeration check boxes, since it is still in phase 2 survey.
14	35	Multiple response acceptable.

Electronic Process Control

Q	Page	Notation
1	37	Multiple response acceptable. Rest of section blank if "None" or "Not sure"
2	37	At least one box checked. If "energy savings" box checked, at least one box is also checked in six savings sub-choices boxes.
3	37	Blank if Q2 has only one box checked. Exactly one box checked otherwise. Q3 response listed to the right of Q2 checked box
4	38	Number written in or a box is checked. Q4<plant hp and plant kW per Additional Range Checks below.
5	38	Number written in or a box is checked. Q5<Q4.
6	38	Exactly one box checked.
7	38	Exactly one box checked. "Don't know" is an acceptable. If "Other", write-in response. If first box is checked, numeric field is completed. Fractional numbers okay. Flag for confirmation if greater than 36.
8	39	Exactly one box checked. "Don't know" is an acceptable "Other" write-in response.
9	39	Exactly one box checked. "Don't know" is an acceptable "Other" write-in response. Make sure write-in is NOT a plant operator name or title. If so, strike out and check box 1 or 3 as appropriate.
10	39	Exactly one box checked. "Don't know" is an acceptable "Other" write-in response. Make sure write-in is NOT a plant operator name or title. If so, strike out and check appropriate box.
11	39	Exactly one box checked. "Don't know" is an acceptable "Other" write-in response. Make sure write-in is NOT a plant operator name or title. If so, strike out and check appropriate box.
12	40	Provide text response
13	40	Exactly one box checked.
14	40	Completed if Q13="Dedicated." Exactly one box checked. Ask if value does NOT make sense compared to kW controlled.

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15	40	Completed if Q13="Both" or "Part of a more complex system." One box checked. Cost makes sense compared to kW controlled.
16	41	Multiple response acceptable.

Gas Process Heating

<u>Q</u>	<u>Page</u>	<u>Notation</u>
1	43	Exactly one box checked. If "No," rest of section is blank.
2	43	Emphasize total annual \$\$\$ for only gas process heating loads . Suggest range if in doubt. Response needs to be recorded, even if answer is "Don't Know."
3	43	Enter value in box that corresponds to their response.
4	43	Provide text response.
5	44	For each gas using equipment, circle Yes or No. Add number of boilers, furnaces etc. after each item. Check which is largest gas user. If OTHER applies, identify name of gas using equipment (use bottom of same page for longer description), and if it is the largest gas user
6	44	Skipped if Q5 has No Boiler. Check as many "measures present" have been done, and if in the previous 3 years.
7	45	Skipped if Q5 has No Boiler. Check as many "Changes ever made" that have been done, and if in the previous 3 years.
8	45	Check as many as apply to the gas process equipment
	45	Enter Relevant Notes, such as using fuel oil when gas is too expensive, cascade heat from exhaust gases to lower temp process heating, etc.

Water Recovery and Re-Use

<u>Q</u>	<u>Page</u>	<u>Notation</u>
1	47	Exactly one box checked. Identify if volume in gallons per day makes sense for size of plant.
2	47	Include text to describe the source(s) not a use of wastewater.
3	47	Multiple responses acceptable.
4	48	Exactly one box checked. If "No," rest of section is blank.
5	48	32 to 212 F or 0 to 100 C
6	48	If gpd provided, same order of magnitude as Q1. Can be bigger or smaller. At least one box or blank completed. No more than one of the '%' blanks checked.
7	48	Exactly one box checked.
8	49	Answered if Q7="Yes." $\text{Btu/hr} < (Q2 + Q5) * 8.33 * (212 - 50) / 24$. $\text{Btu/hr} > \min(Q2, Q5) * 8.33 * (212 - 50) / 24000$.
9	49	Include text to describe the source(s) not a use of recycled water.
10	49	Exactly one box checked. If completed year is between 1900 and 2002.
11	49	Enter a value that makes sense for water recovery rate gallons/day or "Don't know" is checked.
12	49	Enter name and company's location.
13	49	Exactly one box checked. If number provided, it is less than Q11 /12 (e.g. one-month payback time).
14	50	Exactly one box checked. If write-in, make sure words can't fit to a checked box.
15	50	Exactly one box checked. If write-in, make sure words can't fit to a checked box.
16	50	Exactly one box checked. If write-in, make sure words can't fit to a checked box.
17	51	Exactly one box checked. If write-in, make sure words can't fit to a checked box.
18	51	Exactly one box checked if Q17 has more than one box checked. Checked box is also checked in Q17.
19	52	At least one box checked if "Energy costs" selected in Q17 OR Q18. Blank otherwise. If write-in, be certain it can't fit to existing category.

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Refrigeration

Q	Page	Notation
1	54	Exactly one box checked. If "No" rest of section should be blank.
2	54	Exactly one box checked. If "Yes," year range is 1997-2002
3	54	Exactly one box checked, but only if Q3="No.". If Q4="Yes," year range is 1997-2002.
4	55	At least one box checked if Q2 OR Q3 = "Yes."
5	55	Blank if Q5 has one or no boxes checked. Exactly one box checked otherwise. Q5 is included in Q4 boxes checked.
6	55	Exactly one box checked if Q2 OR Q3 = "Yes."
7	56	Exactly one box checked if Q2 OR Q3 = "Yes."
8	56	Completed if Q2 OR Q3 = "Yes." Cost makes sense compared to Q25, asked later.
9	56	Exactly one box checked. If "Yes," year range is 1997-2002
10	56	Exactly one box checked, but only if Q9="No.". If Q10="Yes," year range is 1997-2002.
11	57	At least one box checked if Q9 OR Q10 = "Yes."
12	57	Blank if Q11 has only one box checked. Exactly one box checked otherwise. Q12 is included in Q11 boxes checked.
13	57	Completed if Q9 OR Q10 = "Yes." Cost makes sense compared to Q26, asked later.
14	58	Exactly one box checked. If "Yes," year range is 1997-2002
15	58	Exactly one box checked, but only if Q14="No.". If Q15="Yes," year range is 1997-2002.
16	59	At least one box checked if Q14 OR Q15 = "Yes."
17	59	Blank if Q16 has only one box checked. Exactly one box checked otherwise. Q17 is included in Q16 boxes checked.
18	59	Completed if Q14 OR Q15 = "Yes." Cost makes sense compared to Q27, asked later.
19	60	Exactly one box checked. If "Yes," year range is 1997-2002
20	60	Exactly one box checked, but only if Q19="No.". If Q20="Yes," year range is 1997-2002.
21	61	At least one box checked if Q19 OR Q20 = "Yes"
22	61	Blank if Q21 has only one box checked. Exactly one box checked otherwise. Q22 is included in Q21 boxes checked.
23	61	Completed if Q19 OR Q20 = "Yes" Cost makes sense compared to Q31, asked later.
24	62	At least 20 hp and less than total plant hp. At least 15 tons. See Additional Range Checks below.
25	62	Less than or equal to Q24. Greater than 0 if Q2="Yes." Note: If Q2 <> "Yes", this question is still required because Q2 refers to purchasing heat recovery within the last 5 years. It is possible that hte heat recovery was ALREADY in place. It is likely that the respondent will know and provide these values for Q24 thru Q29 in either tons or hp. There is no single arithmetic conversion from hp to tons, since this will vary by size and age of the equipment.
26	62	Less than or equal to Q24. Greater than 0 if Q9="Yes."
27	62	Less than or equal to Q24. Greater than 0 if Q14="Yes."
28	62	Less than or equal to Q24
29	62	Less than or equal to Q28
30	62	Less than or equal to Q24 / 2. Usually should be greater than 0 if Q24 > 100.
31	62	Less than or equal to Q30
32	62	Exactly one box checked.

Note: The following Quality Control Specifications refer to the Phase II - v2.s - 01/07/03 Industrial Energy End-User Survey ONLY

Power Generation

Q	Page	Notation
1	63	Skipped if Q1=No or DK. Add emphasis on <i>emergency source</i> of power generation and check response in only one box.
	63	If response is no, ask what happens when there is a brown-out or power outage.
2	63	At least one box checked if Q1=Yes. Blank otherwise.
3	63	Completed if Q2 has at least one box other than UPS checked. Also see Additional Range Checks below.
4	63	Exactly one box checked. If "No" or "Don't know", Go to Q12
5	64	Multiple responses acceptable. Check "Other" if description is not better classified in existing categories.
6	64	Exactly one box checked.
7	64	Exactly one box checked.
8	64	Enter a value. Exactly one box checked. Also see Additional Range Checks below.
9	64	0 < Q9 <= 168, or "Don't know."
10	65	If Q9 <> 168, exactly one box checked.
11	65	Multiple responses acceptable. Check "Other" if description is not better classified in existing categories.
12	65	Exactly one box checked. If "No", Go to Closing section (Not Refrigeration)
13	65	If Q12 = Yes, add value and date.

Closing

Q	Page	Notation
1	66	Exactly one box checked. Q2 blank if Q1 is "No."
2	66	Enter value. Determine if value makes sense for plant size. Must provide \$ to benchmark.
3	66	Exactly one box checked.
4	66	Exactly one box checked.
Process Flow Diagram	67	Surveyor to follow instructions or call Jon Maxwell to explain steps needed
	70	AFTER SURVEYOR IS OFF-SITE, Check one box to complete this qualitative assessment

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Note: The following Quality Control Specifications refer to the Phase II - v2.s - 01/07/03 Industrial Energy End-User Survey ONLY

ADDITIONAL RANGE CHECKS.

There are additional range checks we will apply based on utility billing data that WW will not be able to screen for in advance of submission.

First Aspen will get the plant peak kW from the electric billing data. If kW is not available, we will estimate it from annual energy use.

If necessary,

$$\text{peak kW} = \text{annual kWh} / 8760 / 0.6$$

Aspen will then estimate likely total plant motor horsepower, based on a typical mixture of lighting, resistance heat, etc.

$$\text{plant hp} = \text{peak kW} \times 2 / 0.75$$

This parameter will be used for subsequent sanity checks that while they are not rigid requirements, will help flag grossly unusual data.

Motors

<u>Q</u>	<u>Page</u>	<u>Notation</u>
Q8 Total	9	Less than plant hp
Q14	10	Less than plant hp

Process Pumps

Q2	22	Less than plant hp
Q4	22	Less than plant hp

Compressed Air System

Q2	25	Total of all compressor hp is less than plant hp
Q15	28	Less than plant hp
Q16	29	Less than plant hp

Maintenance

Q7	33	Less than plant hp
Q9	34	Less than plant hp

Electronic Control

Q4	38	Less than plant hp or peak kW
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Refrigeration

Q24	62	Less than plant hp
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Power Generation

3	63	Less than plant hp or plant kW.
8	64	Less than plant hp x 2
13	65	Less than plant hp x 2