Title: OPEN PHASE DETECTION SYSTEM AND METHOD FOR THREE-PHASE MOTOR

Abstract: An open phase detection system and method for a three-phase motor (5) are provided, and the system comprises: a signal generating unit (1) coupled to the three-phase motor (5) and configured to generate a driving signal for driving the three-phase motor (5), a detecting unit (2) coupled to the signal generating unit (1) and configured to detect whether the signal generating unit (1) generates the driving signal and to detect three-phase current values of the three-phase motor (5), and a determining unit (3) coupled to the detecting unit (2) and configured to determine whether the three-phase motor (5) has open phase according to the three phase current values detected by the detecting unit (2) when the driving signal was detected.
OPEN PHASE DETECTION SYSTEM AND METHOD FOR THREE-PHASE MOTOR

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority to and benefits of Chinese Patent Application No. 200910189812.4 filed with SIPO on August 31, 2009, the entirety of which is hereby incorporated by reference.

BACKGROUND

TECHNICAL FIELD

The present disclosure relates to an open phase detection system and method for a three-phase motor.

DESCRIPTION OF THE RELATED ART

An open phase of a three-phase motor is that one phase current of three-phase alternating currents loaded on a three-phase motor may be lacked. During start-up or normal operation of the motor, open phase may cause the motor unable to start, or reduce the dynamic performance of the motor, more seriously, may cause short-circuit and burnout of the motor due to over high current and over heating. Thereby, open phase detection of the three-phase alternating currents of the motor is necessary during start-up and normal operation of the motor. At present, the detection of open phase of the three-phase motor is generally realized by detecting a phase difference between the three-phase voltages using a detection circuit. However the detection circuit may comprise many components and have a complex structure.

SUMMARY

The present disclosure is directed to solve at least one of the problems in the prior art.

Accordingly, the present disclosure provides a detection system for a three-phase motor open phase with simple structure.

According to an embodiment of the present disclosure, there is provided an open phase detection system for a three-phase motor, comprising: a signal generating unit coupled to the three-phase motor and configured to generate a driving signal for driving the three-phase motor; a detecting unit coupled to the signal generating unit, and configured to detect whether the signal generating unit generates the driving signal and to detect three-phase current values of the three-phase motor; and a determining unit coupled to the detecting unit, and configured to determine whether the three-phase motor has open phase according to the three phase current values detected by the detecting unit when the driving signal was detected.

According to another embodiment of present disclosure, there is provided an open phase detection
method for a three-phase motor, comprising steps of: detecting whether a driving signal is generated; detecting three phase current values of the three-phase motor when the driving signal is detected; and determining whether the three-phase motor has open phase according to the detected three phase current values.

The detection system and method according to the present disclosure realizes the open phase detection for the motor by detecting the three-phase current value and has a simple structure.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Fig. 1 shows a structural block diagram of the open phase detection system according to an embodiment of the present disclosure;

Fig. 2 shows a relationship of the duty ratios of the three-phase currents corresponding to sectors of the present disclosure;

Fig. 3 shows a structural block diagram of the open phase detection system according to another embodiment of the present disclosure;

Fig. 4 shows a flow chart of the open phase detection method according to the first embodiment of the present disclosure;

Fig. 5 shows a flow chart of the open phase detection method according to the second embodiment of the present disclosure;

Fig. 6 shows a flow chart of the open phase detection method according to the third embodiment of the present disclosure.

**DETAILED DESCRIPTION**

These and other aspects, solutions and advantages of the disclosure will become apparent and more readily appreciated from the following descriptions taken in conjunction with the drawings, and the embodiments should be considered as an explanation instead of limitation to the disclosure.

As shown in Fig. 1, according to an embodiment of the present disclosure, an open phase detection system for a three-phase motor 5 comprises a detecting unit 2, a determining unit 3, a signal generating unit 1 and a control unit 4. The signal generating unit 1 may be electrically coupled with the three-phase motor 5. The detecting unit 2 may be electrically coupled with the signal generating unit 1 and the determining unit 3 respectively. The control unit 4 may be electrically coupled with the determining unit 3 and the signal generating unit 1 respectively.

The signal generating unit 1 is used to generate a driving signal for driving the three-phase motor 5.

The detecting unit 2 may include a signal detecting module 210 used to detect whether the signal generating unit 1 generates the driving signal; and a current detecting module 220 used to
detect the three phase current values of the three-phase motor 5.

The determining unit 3 is used to receive the three-phase currents from the detecting unit 2, and to determine whether one of the three-phase current values is zero. When one of three-phase current values is zero, the three-phase motor 5 is determined to have open phase.

According to another embodiment of the present disclosure, in order to protect the three-phase motor 5 when open phase occurs, The control unit 4 may control the signal generating unit 1 to stop generating the driving signal according to the open phase determination of the determining unit 3.

The open phase detection is performed by controlling the three-phase motor using the space vector pulse width modulation (SVPWM) technology. The technical principle of SVPWM is that: during the three-phase symmetric sinusoidal wave voltage supplying power, a three-phase symmetric motor stator ideal flux circle is used as a reference standard, different switch modes of a three-phase inverter may be used to make appropriate switching, so as to form PWM waves, and an actual flux linkage vector may be formed to trace the accurate flux circle. According to the SVPWM control technology, the different switch modes of a three-phase inverter may divide the 360 degree voltage space into six sectors. As shown in Fig. 2, I, V, IV, VI, II and III sectors may be successively defined. The above sectors may be used to determine a rotor position of the three-phase motor. In each sector, 0, 1 and 2 waves are respectively corresponding to waves of three-phase currents IA, IB and IC. Reference to Fig. 2, the duty ratio a1 of A-phase current value IA in I and VI sectors is equal to that the duty ratio a2 of B-phase current value IB subtracts the duty ratio a3 of C-phase current value IC. Meanwhile, the duty ratio a1 of A-phase current value IA is equal to a predetermined duty ratio value aθ, the A-phase current inrush time is same as the A-phase current outflowing time, so that the currents are offset and the A-phase current value is zero. Similarly, reference to Fig. 2, the duty ratio a2 of B-phase current only in III and IV sectors is equal to the predetermined duty ratio value aθ, that is, the B-phase current IB only in III and IV sectors is zero; the duty ratio a3 of C-phase current IC only in II and V sectors is equal to the predetermined duty ratio value aθ, that is, the C-phase current IC only in II and V sectors is zero. In addition, the duty ratio of the predetermined duty ratio value aθ may be about 45%-55%.

In some embodiments of the present disclosure, the basic principle of open phase detection for the three-phase motor is that: when a phase current value is zero, open phase is determined to occur. However, when the motor is used to a vehicle, during climbing of the vehicle, the vehicle is anchoring on the slope, at that time, the motor is in operation and has no rotational speed, the motor may be in a condition of locked rotor and thereby a phase current loaded on the motor may be permitted to be zero, so that the motor does not has open phase in this situation, and an erroneous judgment on this situation may be avoided according to the sectors and duty ratio.
As shown in Fig. 3, the detecting unit 2 further comprises a rotational speed detection module 230 used to detect a rotational speed of a vehicle wheel; and a rotor position detection module 240 used to detect a rotor position of the three-phase motor 5. Only when the rotation speed of the vehicle is zero and one phase current value is zero, it is necessary to determine the sector in which the rotor is positioned and the duty ratio of the one phase current so as to confirm whether the one phase is open phase. The rotor position detection module 240 is used to detect a rotor position of the three-phase motor 5, that is, to detect the sector in which the rotor is positioned, then to send the detection to the determining unit 3. The rotor position detection module 240 may detect the rotor position by a rotating transformer. When the rotor position is in I and VI sectors and the duty ratio a1 of the A-phase current IA is equal to the predetermined duty ratio value a0, even if the A-phase current value IA is zero, the A-phase of the three-phase motor is not open phase. Similarly, when the rotor position is in III and IV sectors and the duty ratio a2 of the B-phase current IB is equal to the predetermined duty ratio value a0, even if the B-phase current value IB is zero, the B-phase of the three-phase motor is not open phase. When the rotor position is in II and V sectors and the duty ratio a3 of the C-phase current IC is equal to the predetermined duty ratio value a0, even if the C-phase current value is zero, the C-phase of the three-phase motor is not open phase.

In some embodiments, due to the three-phase currents loaded on the motor may easily jump, to avoid the situation of instant current being zero is determined as open phase fault, so as to reduce the misjudgment, the detecting unit 2 may further comprise a current counter used to count the detected currents, a current accumulator and a current calculator used to calculate an average value of the current values.

The control unit 4 may control the signal generating unit 1 to stop generating the driving signal every time the open phase is detected, which may reduce the work efficiency of the motor, in order to avoid the above situation, the control unit 4 may further comprise an open phase counter used to accumulate times of open phase and reset the current accumulator according to determination of the determining unit 3. When times of open phase reaches a set value n, the motor is determined to have open phase, that is, when F is equal to 1, the control unit 4 controls the signal generating unit 1 to stop generating the driving signal.

According to embodiments of the present disclosure, the determining unit 3, the signal generating unit 1 and the control unit 4 may be integrated into a piece of chip such as TMS320F2812DSP chip. The three-phase motor may be a permanent magnet synchronous motor, the detecting unit 2 may be a current sensor and a rotational speed sensor of a vehicle wheel.

The present disclosure further disclosed an open phase detection method for a three-phase motor, comprising steps of: detecting whether the signal generating unit 1 generates a driving signal; detecting three phase current values of the three-phase motor 5 when the driving signal is
detected; and determining whether the three-phase motor 5 has open phase according to the detected three-phase current values by the determining unit 3.

In some embodiments, open phase detection method may further comprise stopping generating the driving signal when the three-phase motor 5 is determined by the determining unit 3 to have open phase.

As shown in Fig. 4, the first embodiment of open phase detection method may comprise detecting whether the signal generating unit 1 generates a driving signal, and terminating the process when the driving signal is not detected; when the driving signal is detected, further detecting whether a rotational speed of a vehicle wheel is zero; determining whether one of the three phase current values is zero when the rotational speed of the vehicle wheel is not zero.

When none of the phase current values of the three phase is zero, that is, \( I_A \neq 0 \), \( I_B \neq 0 \), and \( I_C \neq 0 \), it is determined to have no open phase, and the process is terminated.

When one phase current value is zero, that is \( I_A=0 \), \( I_B=0 \) or \( I_C=0 \); that is, \( AF=I \), \( BF=I \) or \( CF=I \), the motor is determined to have open phase.

When the open phase is determined by the determining unit 3, the control unit 4 may control the signal generating unit 1 to stop generating the driving signal.

With open phase detection method of the first embodiment of the present disclosure, the three-phase currents may be determined in turn from A-phase to C-phase, or from C-phase to A-phase. The determining order of the three-phase currents may be randomly combined and not limited to above. Only when \( AF \), \( BF \) and \( CF \) are all equal to zero, the three-phase motor 5 is determined to have no open phase; if any one of \( AF \), \( BF \) and \( CF \) is equal to one, the three-phase motor 5 is determined to have open phase.

During climbing of a vehicle, the vehicle is anchoring on a slope, at that time, the motor is in operation and has no rotational speed. The motor may be under a condition of locked rotor, and a phase current loaded on the motor may be zero, but the motor does not have open phase in this situation. To avoid the misjudgment in this situation, as shown in Fig. 5, the second embodiment of the present disclosure may further comprise the following steps:

- when the rotational speed of the vehicle wheel is zero, the determining unit 3 may determine whether the A-phase current value \( I_A \) is zero;
- when the A-phase current value \( I_A \) is zero, the determining unit 3 may further determine whether the rotor position of the three-phase motor is in \( I \) or \( VI \) sector;
- when the rotor position of the three-phase motor 5 is not in \( I \) or \( VI \) sector, the motor is determined to have open phase, that is \( AF=I \), and the control unit 4 may control signal generating unit 1 to stop generating a driving signal;
- when the rotor position of the three-phase motor 5 is in \( I \) or \( VI \) sector, it is further determined whether a duty ratio \( a_f \) of A-phase current is equal to a predetermined duty ratio value.
if the duty ratio \( a_0 \) of A-phase current is not equal to the predetermined duty ratio value \( a_0 \), the motor is determined to have open phase, that is \( AF=1 \), and the control unit 4 may control signal generating unit 1 to stop generating a driving signal;

if the duty ratio \( a_1 \) of A-phase current is equal to the predetermined duty ratio value \( a_0 \), it is determined that A-phase is not open phase, that is \( AF=0 \);

when the A-phase current value is not zero, it is determined that the A-phase is not open phase, that is \( AF=0 \).

when \( AF=0 \), it is determined whether the B-phase current value is zero;

When the B-phase current value is zero, the determining unit 3 determines whether the rotor position of the three-phase motor 5 is in III or IV sector;

if the rotor position of the three-phase motor is not in III or IV sector, the motor is determined to have open phase, that is \( BF=1 \), and the control unit 4 may control signal generating unit 1 to stop generating a driving signal;

when the rotor position of the three-phase motor 5 is in III or IV sector, it is further determined whether a duty ratio \( a_2 \) of B-phase current \( IB \) is equal to the predetermined duty ratio value \( a_0 \);

If the duty ratio \( a_2 \) of B-phase current \( IB \) is not equal to the predetermined duty ratio value \( a_0 \), the motor is determined to have open phase, that is \( BF=1 \), and the control unit 4 may control signal generating unit 1 to stop generating a driving signal;

when the duty ratio \( a_2 \) of B-phase current \( IB \) is equal to the predetermined duty ratio value \( a_0 \), it is determined that the A-phase and B-phase are not open phase, that is \( AF=0 \) and \( BF=0 \);

when \( AF=0 \) and \( BF=0 \), it is further determined whether the C-phase current is zero;

when the C-phase current value \( IC \) is not zero, the motor is determined to have no open phase, that is \( AF=0, BF=0 \) and \( CF=0 \), and the process is terminated;

when the C-phase current value \( IC \) is zero, the determining unit 3 further determines whether the rotor position of the three-phase motor 5 is in II or V sector;

if the rotor position of the three-phase motor is not in II or V sector, the motor is determined to have open phase, that is \( CF=1 \), the control unit 4 may control signal generating unit 1 to stop generating the driving signal;

when the rotor position of the three-phase motor 5 is in II or V sector, it is further determined whether a duty ratio \( a_3 \) of the C-phase current \( IC \) is equal to the predetermined duty ratio value \( a_0 \);

if the duty ratio \( a_3 \) of C-phase current \( IC \) is equal to the predetermined duty ratio value \( a_0 \), the motor is determined to have no open phase, that is \( AF=0, BF=0 \) and \( CF=0 \), and the process is terminated;
when the duty ratio $\alpha_3$ of the C-phase current $I_C$ is not equal to the predetermined duty ratio value $\alpha_\theta$, the motor is determined to have open phase, that is $CF=I$, the control unit 4 may control signal generating unit 1 to stop generating a driving signal.

Because the three-phase currents loaded on the motor may easily jump, to avoid the situation of instant current being zero is determined as the motor has open phase, and to avoid decrease of the work efficiency of the motor, after the generating unit 1 generates a driving signal, as shown in Fig. 6, according to the third embodiment of the present disclosure, open phase detection method further comprises the following steps:

when the detecting unit 2 detects the driving signal, it is further determined whether times $T$ of currents detected by the current counter of the three-phase currents is smaller than a preset value $n$;

if times $T$ is smaller than the preset value $n$, the current accumulator may accumulate the three-phase currents $IA$, $IB$ and $IC$ respectively;

if times $T$ is larger than or equal to the preset value $n$, times $T$ of the three-phase current is reset, and an average value of the accumulated values of $IA$, $IB$ and $IC$, and the average value may be used in subsequent open phase determination.

Because the open phase is not frequently occurred, if the open phase determination is frequently performed, the process may be complex. Therefore, it is not suitable that the preset value $n$ is too small. However, in order to avoid jump of the current bring misjudgment, the preset value $n$ can not be too big. Therefore, the preset value $n$ is about 1000 to about 10000.

After detecting whether the three-phase currents $IA$, $IB$ and $IC$ are open phase, the above open phase detection method may further comprise the following steps:

whether the three phases are open phase, all the accumulated three-phase current values $IA$, $IB$ and $IC$ are reset, then it is further determined whether flag bit of one of three-phase currents is 1:

when the flag bits of the three-phase currents are all zero, that is $AF=O$, $BF=O$ and $CF=O$, the open phase counter count is equal to 0, the process is terminated;

when flag bit of one of three-phase currents is 1, that is when $AF=I$, $BF=I$ or $CF=I$, the open phase counter count may begin to accumulate;

when count is larger than the set value $n_1$, the total flag bit $F=I$, the control unit 4 may control signal generating unit 1 to stop generating the driving signal, and the process is terminated.

The above set value $n_1$ is in the range of about 10000 to about 120000, that is only if successive open phase times of the three-phase currents is about 10000 to about 120000, the control unit 4 may control the signal generating unit 1 to stop generating the driving signal. Of course, the successive open phase times of the three-phase currents being about 10000 to about
120000 is acceptable and there will be no damage to the motor. If the open phase counter count still don’t reach the set value nl, when the flag bits of the three-phase current are all zero, the open phase counter count is reset, that is, the open phase counter count=0.

According to above third embodiment of the present disclosure, open phase detection method further comprises calculating an average value of currents and accumulating the open phase times. However, the aforementioned two steps may not be needed to simultaneously perform in open phase detection method, only one step thereof is also acceptable.

Although explanatory embodiments have been shown and described, it would be appreciated by those skilled in the art that changes, alternatives, and modifications can be made in the embodiments without departing from spirit and principles of the disclosure. Such changes, alternatives, and modifications all fall into the scope of the claims and their equivalents.
WHAT IS CLAIMED IS:

1. An open phase detection system for a three-phase motor, comprising:
   a signal generating unit coupled to the three-phase motor and configured to generate a
   driving signal for driving the three-phase motor;
   a detecting unit coupled to the signal generating unit, and configured to detect whether the
   signal generating unit generates the driving signal and to detect three-phase current values of the
   three-phase motor; and
   a determining unit coupled to the detecting unit, and configured to determine whether the
   three-phase motor has open phase according to the three phase current values detected by the
   detecting unit when the driving signal was detected.

2. The system according to the claim 1, further comprising:
   a control unit coupled to the signal generating unit and the determining unit respectively,
   and configured to control the signal generating unit to stop generating the driving signal if open
   phase was detected.

3. The system according to the claim 1, wherein the detecting unit comprises:
   a signal detecting module configured to detect whether the signal generating unit generates
   the driving signal; and
   a current detecting module configured to detect the three phase current values of the
   three-phase motor.

4. The system according to claim 3, wherein the detecting unit further comprises:
   a rotational speed detecting module configured to detect a rotational speed of a vehicle
   wheel; and
   a rotor position detecting module configured to detect a rotor position of the three-phase
   motor.

5. The system according to the claim 4, wherein the determining unit is further configured to
   determine whether the three-phase motor has open phase according to the rotational speed of the
   vehicle wheel, the rotor position of the three-phase motor, a predetermined duty ratio value a0 of
   the three-phase motor, and the detected three-phase current values.

6. The system according to the claim 4, wherein the detecting unit further comprises:
   a current counter configured to count currents detected;
   a current accumulator configured to accumulate each of the three-phase current values
respectively; and

a current calculator configured to compute an average value of the detected current values.

7. The system according to claim 4, wherein the control unit further comprises an open phase counter configured to accumulate times of open phase.

8. The system according to claim 7, wherein the control unit is further configured to reset the current accumulator according to determination received from the determining unit.

9. The system according to claim 3, wherein the determining unit, the signal generating unit and the control unit may be integrated into a piece of chip.

10. An open phase detection method for a three-phase motor, comprising steps of:

detecting whether a driving signal is generated;

detecting three phase current values of the three-phase motor when the driving signal is detected; and

determining whether the three-phase motor has open phase according to the detected three phase current values.

11. The method according to claim 10, further comprising:

stopping generating the driving signal when the three-phase motor is determined to have open phase.

12. The method according to claim 10 or 11, further comprising:

detecting whether a rotational speed of a vehicle wheel is zero when the driving signal is detected; and

determining whether one of the three-phase current values is zero when the rotational speed of a vehicle wheel is not zero; and

determining the three-phase motor to have open phase when one of the three phase current values is zero.

13. The method according to claim 12, further comprising:

determining whether the three-phase motor has open phase according to the rotational speed of the vehicle wheel, a rotor position of the three-phase motor, a predetermined duty ratio value of the three-phase motor, and the three-phase current values.
14. The method according to claim 13, further comprising:

determining whether an A-phase current value is zero when the rotational speed of the vehicle wheel is zero;

determining whether the rotor position of the three-phase motor is in I or VI sector when the A-phase current value is zero;

determining the three-phase motor has open phase if the rotor position of the three-phase motor is not in I or VI sector;

determining whether a duty ratio $a_1$ of the A-phase current is equal to a predetermined duty ratio value $a_0$ when the rotor position of the three-phase motor is in I or VI sector;

determining the A-phase of the motor is not open phase if the duty ratio $a_1$ of A-phase current is equal to the predetermined duty ratio value $a_0$;

determining the three-phase motor has open phase when the duty ratio $a_1$ of the A-phase current is not equal to the predetermined duty ratio value $a_0$;

determining whether the B-phase current value is zero when the A-phase is not open phase;

determining whether the rotor position of the three-phase motor is in III or IV sector when the B-phase current value is zero;

determining the three-phase motor has open phase if the rotor position of the three-phase motor is not in III or IV sector;

determining whether a duty ratio $a_2$ of the B-phase current is equal to a predetermined duty ratio value $a_0$ when the rotor position of the three-phase motor is in III or IV sector;

determining the A-phase and B-phase of the motor are not open phase if the duty ratio $a_1$ of B-phase current is equal to the predetermined duty ratio value $a_0$;

determining the three-phase motor has open phase when the duty ratio $a_2$ of the B-phase current is not equal to the predetermined duty ratio value $a_0$;

determining whether the C-phase current value is zero when the A-phase and B-phase are not open phase;

determining whether the rotor position of the three-phase motor is in II or V sector when the C-phase current value is zero;

determining the three-phase motor has open phase if the rotor position of the three-phase motor is not in II or V sector;

determining whether a duty ratio $a_3$ of the C-phase current is equal to a predetermined duty ratio value $a_0$ when the rotor position of the three-phase motor is in II or V sector;

determining the three-phase motor has no open phase if the duty ratio $a_3$ of C-phase current is equal to the predetermined duty ratio value $a_0$; and

determining the three-phase motor has open phase when the duty ratio $a_3$ of the C-phase current is not equal to the predetermined duty ratio value $a_0$. 
15. The method according to claim 13, further comprising:

determining whether times T of the detected three phase currents is smaller than a preset
value n when the driving signal is detected;

accumulating the three phase current values IA, IB and IC respectively if times T is smaller
than the preset value n; and

resetting times T and calculating an average value of the accumulated values of IA, IB and
IC if times T is larger than or equal to the preset value n.

16. The method according to claim 15, wherein the preset value n is in a range of about 1000 to
10000.

17. The method according to claim 15, further comprising:

resetting the accumulated values of the three phase current values IA, IB and IC;

determining whether flag bit of one of three phase currents is 1;

resetting an open phase count and terminating operation if the flag bit of each of the
three-phase currents is zero; and

accumulating the open phase count when the flag bit of one of three-phase current is 1, and
setting open phase flag bit F of the motor to l when the open phase count is larger than or equal to
a set value n1, and stopping generating the driving signal.

18. The method according to claim 17, wherein the set value n1 is in a range of about 10000 to
120000.
Fig. 3
Fig. 4

start

whether generating a driving signal?

Y

whether the rotational speed of the vehicle wheel is zero?

N

IA = 0?

Y

AF=1

N

IN = 0?

Y

BF=1

N

IC ≠ 0?

Y

CF=1

N

AF, BF, CF=0

stop generating a driving signal

end
Fig. 5
Fig. 6
INTERNATIONAL SEARCH REPORT

International application No
PCT/CN2010/076444

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC G01R, H02H7, H02H3

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)


C. DOCUMENT S CONSIDERED TO BE RELEVANT

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<th>Category*</th>
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* Further documents are listed in the continuation of Box C

T: later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X: document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y: document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

&"document member of the same patent family

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08 Nov 2010 (08 11 2010)

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100088
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Form PCT/ISA /210 (second sheet) (July 2009)
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Form PCT/ISA /210 (patent family annex) (July 2009)
### A. CLASSIFICATION OF SUBJECT MATTER

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